DOCUMENT RESUME

ED 122 451 95 EA 008 248

AUTHOR	Barro, Stephen M.; Carroll, Stephen J.
TITLE	Budget Allocation by School Districts: An Analysis of Spending for Teachers and Other Resources.
INSTITUTION	Rand Corp., Santa Monica, Calif.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.
REPORT NO	R-1797-NIE
PUB DATE	Dec 75
GRANT	NE-G-00-3-0175
NOTE	139p.
EDRS PRICE	MF-$0.83 HC-$7.35 Plus Postage.
DESCRIPTORS	Administrative Personnel; *Budgeting; *Educational Finance; Elementary Secondary Education; Expenditure Per Student; Personnel Policy; *Resource Allocations; *School District Spending; Statistical Analysis; Student Teacher Ratio; Teacher Background; Teacher Salaries; Teaching Experience
IDENTIFIERS	*Michigan

ABSTRACT

The objective of this study is to provide partial answers to the question, "What would school districts buy if they were given additional funds?" The answers are potentially relevant to state and federal education policy-makers faced with the task of developing and implementing school finance reforms who must consider whether and under what conditions local school systems will use additional funds effectively. The focus of the study is on school district choices among resource inputs. An attempt is made to determine how much of any increment in a school district's budget tends to be used (a) to increase the teacher-pupil ratio, (b) to raise the teachers' salary schedule, (c) to hire teachers with more experience and training, (d) to pay for professional personnel other than teachers, and (e) to purchase other resources. Variations in resource allocation patterns among districts with different socioeconomic characteristics are also examined. The study does not address the questions of how resources are used within the schools or of the extent to which different categories of children in a school district are likely to benefit from incremental resources. (Author)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED122451

BUDGET ALLOCATION BY SCHOOL DISTRICTS: AN ANALYSIS OF SPENDING FOR TEACHERS AND OTHER RESOURCES

PREPARED UNDER A GRANT FROM THE NATIONAL INSTITUTE OF EDUCATION

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

STEPHEN M. BARRO
STEPHEN J. CARROLL

R-1797-NIE
DECEMBER 1975

EA 008 248

2

Rand
SANTA MONICA, CA. 90406

The research described in this report was done for the National Institute of Education under Grant No. NE-00-3-0175. Reports of The Rand Corporation do not necessarily reflect the opinions or policies of the sponsors of Rand Research.

Published by The Rand Corporation

BUDGET ALLOCATION BY SCHOOL DISTRICTS: AN ANALYSIS OF SPENDING FOR TEACHERS AND OTHER RESOURCES

PREPARED UNDER A GRANT FROM THE NATIONAL INSTITUTE OF EDUCATION

STEPHEN M. BARRO
STEPHEN J. CARROLL

R-1797-NIE
DECEMBER 1975

Rand
SANTA MONICA, CA. 90406

PREFACE

This study, sponsored by the National Institute of Education, is an outgrowth of Rand research on school finance policy and on the structure and functioning of the educational personnel system in the United States. It addresses the question of how school districts adjust their spending patterns when the amount of money available to them increases or decreases. The study focuses on school district decisions about resource inputs. The objective is to develop statistical relationships that can be used to estimate the effects on expenditure patterns, staffing ratios, and salary schedules of changes in total funding per pupil. Budgetary changes of the kinds examined here are likely to take place either as a result of efforts to reform state school finance systems or in response to changing economic circumstances. Therefore, our findings should be of interest to state and federal officials charged with designing, evaluating, and implementing school finance policy. The models and methods used to investigate the allocative behavior of school districts should also be of interest to researchers in the fields of educational finance and administration, public finance, and labor economics.

Related Rand studies include:

Arthur J. Alexander, *Teachers, Salaries, and School District Expenditures*, R-1588-FF, October 1974.

Arthur J. Alexander, *Inequality in California School Finance: Dimensions, Sources, Remedies*, R-1440-FF, March 1975.

Stephen M. Barro, *Theoretical Models of School District Expenditure Determination and the Impact of Grants-in-Aid*, R-867-FF, February 1972.

Stephen J. Carroll, *Analysis of the Educational Personnel System: III. The Demand for Educational Professionals*, R-1308-HEW, October 1973.

John Pincus (ed.), *School Finance in Transition*, Ballinger Publishing Company, Cambridge, Mass., 1974.

Part of this study, a cross-sectional analysis of the allocative behavior of Michigan school districts, replicates a similar study done with California data, which was reported in the first document by Arthur J. Alexander cited above. The mutually supporting nature of the findings from these two studies illustrates the value of a strategy of cumulative progress in this field.

SUMMARY

OBJECTIVES

The objective of this study is to provide partial answers to the question, "What would school districts buy if they were given additional funds?" The answers are potentially relevant to state and federal education policymakers faced with the task of developing and implementing school finance reforms who must consider whether and under what conditions local school systems will use additional funds effectively. The focus of the study is on school district choices among resource inputs. We have attempted to determine how much of any increment in a school district's budget tends to be used (a) to increase the teacher-pupil ratio, (b) to raise the teachers' salary schedule, (c) to hire teachers with more experience and training, (d) to pay for professional personnel other than teachers, and (e) to purchase other resources. We have also examined variations in resource allocation patterns among districts with different socioeconomic characteristics. The study does not address the questions of how resources are used within the schools or of the extent to which different categories of children in a school district are likely to benefit from incremental resources.

METHODS

The analysis is based on cross-sectional comparisons among Michigan school districts. It uses data from the 1968-69 and 1969-70 school years on 195 Michigan districts with 2000 or more pupils in average daily attendance. These data were analyzed by the two statistical methods described below.

Single-Year, Cross-Sectional Analysis

The first method was to develop cross-sectional statistical relationships among the magnitudes of interest, using data for one school year at a time. The dependent variables in these relationships include per pupil expenditures for teachers and other categories of resources, teacher-pupil and staff-pupil ratios, teacher experience and education, and average

teacher salaries and salary schedule parameters. Independent variables include the size of the district budget (total current expenditure per pupil), price variables, and selected socioeconomic characteristics of the districts. The analysis was carried out in three steps: In step one, we investigated the determinants of per pupil spending for teachers, administrators, specialists, and other resources. In step two, we divided per pupil expenditure for teachers into two components, teacher-pupil ratio and average teacher salary, and examined the response of each component to changes in the budget level and other variables. In step three, we broke down average teacher salary into five components--two attributes of the teaching force in a school district, average experience and average degree level, and determinants of three salary schedule parameters, starting salary, experience increment, and degree increment. Each of the five components was treated as the dependent variable in a set of regression equations. To carry out step three, we had to develop a special statistical procedure for estimating salary schedule parameters for each district from data on salaries of individual teachers.

The design of the cross-sectional analysis created several opportunities for cross-checking results. First, the step-by-step approach made it possible to check the internal consistency of findings at several points. Second, we were able to compare estimates from separate regression equations using 1968-69 and 1969-70 data. Third, we had the opportunity to compare our results with those of a similar Rand study of California school districts by Arthur Alexander, published in 1974; this provided an external check on the validity of our findings.

Discretionary Budget Analysis

The second analytical approach is based on the concept of the "discretionary budget"--that portion of a given year's budget that is not committed to support of personnel and other resources retained by school districts from the previous year. We assumed that each Michigan district was obligated in 1969-70 to pay all retained teachers at least the amount called for by the 1968-69 salary scale before considering other uses of funds. Because we had detailed data on personnel and finances for two school years, we were able to determine the per pupil costs of meeting these obligations. We developed four alternative measures of the amount of discretionary money per pupil in 1969-70, corresponding to alternative assumptions about the nature and extent of district commitment.

The discretionary funds available to a district may be used (a) to hire new teachers, (b) to raise the level of the teachers' salary schedule, (c) to employ new teachers with more than minimal levels of experience and training, and (d) to pay for increments in nonteacher resources per pupil. In this method of analysis, these resource or salary increments are the dependent variables. The independent variables include the amount of discretionary money per pupil, amounts of inherited resources per pupil, base-year levels of resources per pupil, price variables, and socioeconomic characteristics of the districts. By formulating a theoretical model of district behavior, we were able to set up a series of a priori hypotheses about relationships between the dependent and independent variables.

FINDINGS FROM THE CROSS-SECTIONAL ANALYSIS

Resource Allocation in Relation to Budget Level

The most important findings from the cross-sectional analysis describe the rates at which budget allocations change as total spending per pupil increases. We found that per pupil expenditure for teachers increases by about three-fourths of one percent for each one percent increase in the budget. This means that a smaller fraction of each successive budget increment is expended for teachers. Spending for administrators increases slightly less than in proportion to total spending per pupil. Spending for specialists, supplies and equipment increases more rapidly than total spending--by about 1.4 percent and 1.6 percent, respectively, for each one percent rise in the budget. The 1968-69 and 1969-70 estimates of these expenditure elasticities are consistent in most cases. Our estimates of the elasticity of per pupil expenditure for teachers with respect to budget are also consistent with the estimate obtained by Alexander from his California study.

We found that a larger share of a given percentage increase in per pupil spending translates into smaller class sizes than into higher pay for teachers. According to the 1969-70 results, a one percent increase in total spending per pupil is associated with a .50 percent increase in the teacher-pupil ratio and a .29 percent increase in average teacher salary. These results are roughly consistent with Alexander's California estimates, if certain differences in definitions and samples are taken into account. We also found that the ratio of total staff (teachers, administrators, and specialists) to pupils increases more rapidly with budget than does the teacher-pupil ratio.

We found that teacher starting salary is insensitive to the budget level. It increases by only about .15 percent for each one percent increase in total per pupil spending. The salary increment paid for each year of teaching experience increases more rapidly; the 1968-69 elasticity estimate is .40 and the 1969-70 estimate is .20. The salary increment paid to teachers who earn an M.A. degree appears to increase still more rapidly with budget; the 1968-69 and 1969-70 elasticity estimates are .66 and .50, respectively. However, the validity of these estimates is doubtful because of shortcomings of the procedure used to measure degree increments paid by each school district. Our findings about the starting salary level and experience increment parameters are similar to Alexander's; no direct comparison of findings about the degree increment parameter is possible. As to teacher characteristics, we found that the average number of years of experience of a district's teachers tends to increase by about .35 percent for each one percent increase in the district's budget. The percentage of teachers with M.A. degrees increases much more rapidly--by about 1.2 percent for each one percent rise in total outlays.

The findings about salary schedule parameters and teacher characteristics, taken together, imply that in an "average" district, about 55 percent of the increase in average teacher salary associated with an increase in the budget would be attributable to higher average levels of teacher experience and education. The remaining 45 percent would be attributable to increases in the salary schedule itself.

Effects of Price Variables and Socioeconomic Characteristics of Districts

We found that the teacher-pupil ratio is price inelastic; it declines by about two-tenths of one percent in response to a one percent increase in starting salary. The same effect was observed when starting salary was replaced by clerical income, which we used as a proxy for the "opportunity wage" available to teachers. However, evidence from other parts of the analysis raised doubts about whether clerical income is really an adequate opportunity wage measure.

The socioeconomic status (SES) of a school district is represented in the analysis by percentages of employed persons in high-level (professional, technical, and managerial) and middle-level (sales, clerical, and crafts) occupations, and by the percentage of adults with some college education. We found that per pupil spending for teachers and administrators is positively associated and per pupil expenditures for "other" resources are negatively associated with SES. Per pupil spending for teachers also tends to be lower in central city school districts and in districts with high concentrations of minority pupils. On the other hand, these districts spend more per pupil for specialists. The lower outlays for teachers in these districts are reflected in lower teacher-pupil ratios, rather than lower average salaries. Average teacher salary did not vary in a consistent manner with any SES characteristic.

The effects of SES characteristics on the components of average teacher salary are more complicated. Contrary to expectations, teacher starting salary tends to be low in high-SES districts, but higher in middle-SES than in low-SES districts. The increment paid for each year of teaching experience is smallest in low-SES districts, as expected, but the average number of years of teacher experience is higher in those districts than elsewhere. The increment paid for experience also tends to be high in districts with large minority populations, while the average level of experience tends to be high in central city districts. Neither the salary increment paid for an M.A. degree nor the percentage of teachers in a district who have M.A. degrees was found to be affected by any SES characteristic.

We have more confidence in the findings pertaining to expenditure variables and teacher-pupil ratio than in those pertaining to the components of average teacher salary. Fractions of variance explained (R^2) are relatively low for the latter set of variables, and there are serious measurement problems in connection with the degree increment parameter of the teacher salary schedule. Nevertheless, on the basis of comparisons between the 1968-69 and 1969-70 regression equations and between our findings and Alexander's, we believe that we have obtained a reasonably accurate overall picture of the way in which budget allocations are related to the level of school district spending.

FINDINGS FROM THE DISCRETIONARY BUDGET ANALYSIS

The main findings from the discretionary budget analysis relate to the effects of the size of the discretionary budget and amounts of retained and prior-year resources on school districts' uses of discretionary funds. As hypothesized, all dependent variables are positively related to the amount of discretionary money per pupil. Findings about the effects of other independent variables are as follows:

The number of newly hired teachers in a district is positively related to the teacher-pupil ratio in the previous year and negatively related to the number of retained teachers per pupil. We interpret the former variable as a measure of the district's "taste" for teacher-pupil ratio and the latter as reflecting the number of terminating teachers that must be replaced. The number of newly hired teachers is also negatively related to the starting salary level, as expected.

The increment in per pupil spending for nonteacher resources is positively related to the ratio of retained teachers to pupils and negatively related to the teacher-pupil ratio in the previous year. The interpretation of this is simply that the more new teachers the school district is inclined to hire, the less it can spend on other resources. The increment in nonteacher spending also tends to be lower when the base-year level of spending for resources other than teachers is high.

The year-to-year rate of increase in the level of the teacher salary schedule is negatively related to the ratio of retained teachers to pupils, the base-year teacher-pupil ratio, and the level of starting salary in the base year. All three effects are as hypothesized.

The amount by which salaries of newly hired teachers exceed the starting salary (which is a composite measure of the levels of experience and training of new teachers) is positively related to the base-year teacher-pupil ratio and negatively related both to the ratio of retained teachers to pupils and to base-year starting salary. Also, contrary to hypothesis, the position of new teachers on the salary schedule is positively related to the position of retained teachers on the schedule and negatively related to the average position on the schedule of all teachers in the base year. These results are difficult to interpret, and they appear incompatible with a theory of rational allocative behavior by the school district. They are compatible, however, with a theory of choice by individual teachers. Thus, the findings support the proposition that districts have relatively little control over the experience and training characteristics of their teaching forces.

Taken as a whole, the results support the validity of the discretionary budget formulation. The regression equations with the number of newly hired teachers per pupil and the increment in nonteacher resources per pupil as dependent variables perform exceptionally well. The explanatory power of the other equations is not as good, but this is not surprising in view of the methods by which some of the dependent and independent variables were constructed. All a priori hypotheses were verified, except for the two noted above. In general, the regression equations that performed best contained the most restrictive definition of the discretionary budget--one in which each district was assumed to have inherited obligations with respect to all categories of resources, not only teachers. This supports the proposition that districts tend to budget incrementally, concerning themselves mainly with allocations of the funds not needed to fulfill past commitments.

CONCLUSIONS

Mutually supporting findings from the cross-sectional regression equations for both school years, the discretionary budget analysis, and Alexander's California study provide a reasonable basis for believing that the cross-sectional model accurately represents the effects of changes in the school district budget on expenditure components, teacher-pupil ratio, and staff-pupil ratio. There is less reason to have confidence in results concerning the individual parameters of the teacher salary schedule. Findings about the effects of budget changes on average teacher experience and training should be discounted heavily because there is evidence that those outcomes are determined mainly by choices of individual teachers rather than by choices of district officials, as the model implies.

According to the 1969-70 regression equations, an "average" district tends to spend less than half (48 percent) of an increment in per pupil expenditure for teachers. Of the additional expenditure for teachers, a larger share (63 percent) is accounted for by increases in the teacher-pupil ratio than by increases in average salary. Only about 10.5 cents out of a one dollar per pupil increment in the budget tends to be spent to raise the level of the teacher's salary schedule. These conclusions are very similar to Alexander's conclusions about California school districts despite differences in the detailed numerical results.

There are major limitations on the usefulness of the empirical findings of this study for causal inference and prediction. A promising approach for overcoming them would be to develop explicit models of the supply of currently employed and new teachers, building on the discretionary budget framework set forth in this report.

ACKNOWLEDGMENTS

We gratefully acknowledge the assistance of Dr. John W. Porter, Superintendent of Public Instruction, Michigan State Department of Education, and Dr. C. Philip Kearney, Associate Superintendent for Research and Administration, who made it possible for the authors to use the data on which this report is based. We also wish to thank our Rand colleague, Dr. Paul Berman, and Professor Richard J. Murnane, of the University of Pennsylvania, for detailed and extremely helpful reviews of an earlier draft.

CONTENTS

PREFACE iii

SUMMARY v

ACKNOWLEDGMENTS xiii

Section
I. INTRODUCTION 1
    Objectives of the Study 1
    Overview of the Analysis 2
    Theoretical Perspective 5
    Data 8
    Plan of the Study 9

II. EXPENDITURES FOR TEACHERS, ADMINISTRATORS, SPECIALISTS, AND OTHER RESOURCES 11
    Variables 11
    Bivariate Regressions 11
    Multivariate Regressions for Teacher Expenditures 14
    Multivariate Regressions for Other Expenditure Components 19
    Summary of Findings 22

III. TEACHER-PUPIL AND STAFF-PUPIL RATIOS AND AVERAGE TEACHER SALARIES 25
    Relationships of Teacher-Pupil Ratio and Average Salary to Total Spending per Pupil 26
    Regression Equations for Teacher-Pupil Ratio 28
    Regression Equations for Average Teacher Salary 34
    Regression Equations for Staff-Pupil Ratio 38
    Summary of Findings 41

IV. THE DETERMINANTS OF TEACHER SALARIES 43
    Variables 44
    Regression Equations for Salary Schedule Parameters 47
    Regression Equations for Average Teacher Experience and Percent with M.A. Degree 54
    Sources of Variation in Average Teacher Salary 58
    Summary of Findings 60

V. THE DISCRETIONARY BUDGET MODEL 62
    Resource Constraints and the Discretionary Budget 63
    Estimating the Interyear Increase in Teacher Salary Schedules 67
    Dependent Variables 68
    Hypotheses 69

VI. EMPIRICAL ANALYSIS OF DISCRETIONARY BUDGET ALLOCATION 75
  Regression Equations for Newly Hired Teachers 75
  Regression Equations for Increase in Nonteacher Spending per Pupil 81
  Regression Equations for the Rate of Increase in the Teacher Salary Schedule 83
  Regression Equations for Entry Salaries of Newly Hired Teachers 85
  Overall Findings from the Discretionary Budget Analysis . . 89

VII. INTEGRATION OF FINDINGS AND CONCLUSIONS 91
  Integration of Findings 91
  Conclusions about the Determinants of Budgetary Outcomes 94
  Limitations 97

Appendix 103

TABLES

1. Variables in the Cross-Sectional Analysis of Expenditure Categories 12

2. Regression Equations for Teacher Expenditure Per Pupil, 1969-70 15

3. Regression Equations for Teacher Expenditure Per Pupil, 1968-69 16

4. Regression Equations for Expenditures on Administrators, Specialists, and "Other" Resources, 1969-70 20

5. Regression Equations for Expenditures on Administrators, Specialists, and "Other" Resources, 1968-69 21

6. Elasticities of Teacher-Pupil Ratio, Average Teacher Salary, and per Pupil Spending for Teachers with Respect to the per Pupil Budget 27

7. Regression Equations for Teacher-Pupil Ratio, 1969-70 28

8. Regression Equations for Teacher-Pupil Ratio, 1968-69 29

9. Regression Equations for Average Teacher Salary, 1969-70 35

10. Regression Equations for Average Teacher Salary, 1968-69 36

11. Regression Equations for Staff-Pupil Ratio, 1969-70 39

12. Regression Equations for Staff-Pupil Ratio, 1968-69 40

13. Distribution of R^2 in Estimating Equations for Teachers' Salary Parameters 48

14. Regression Equations for Teacher Starting Salary, Degree Increment, and Experience Increment, 1969-70 49

15. Regression Equations for Teacher Starting Salary, Degree Increment, and Experience Increment, 1968-69 50

16. Regression Equations for Average Teacher Experience and Percent Teachers with Master's Degree, 1969-70 55

17. Regression Equations for Average Teacher Experience and Percent Teachers with Master's Degree, 1968-69 56

18. Variables in the Analysis of Allocation of the Discretionary budget 76

19. Regression Equations for Ratio of Newly Hired Teachers to Pupils in 1969-70 77

20. Regression Equations for Increase in per Pupil Spending for Resources Other than Teachers, 1968-69 to 1969-70 82

21. Regression Equations for Increase in Level of the Teacher Salary Schedule, 1968-69 to 1969-70 84

22. Regression Equations for the Fraction by Which Average Salary of Newly Hired Teachers Exceeds Starting Salary, 1969-70 87

I. INTRODUCTION

OBJECTIVES OF THE STUDY

One of the major unknowns in evaluating proposed changes in state or federal school finance systems is how local public school districts would respond to increases or decreases in funds. Would they use additional revenue to hire more teachers, increase support staffs, raise salaries, or provide more equipment and supplies? Would they use it to provide new services and new modes of service delivery or "more of the same"? The attitudes of state and federal policymakers toward school finance reform might be significantly influenced by the answers to these questions. Much concern has been expressed that higher budgets either would translate into higher staff salaries, with little corresponding increase in staff quality, or would be used to reduce class sizes, despite evidence that smaller classes alone do little to improve educational results. On the other hand, it is possible that additional resources would be used to upgrade staffs, to provide new types of supporting services, or to change existing educational practices and modes of resource deployment in educationally beneficial ways. Information on how local districts would use incremental funds (or how they would adjust to budget reductions) could be helpful to policymakers in two ways. First, it would help them in judging the merits of proposals for increased aggregate support or for redistribution of funds among districts. Second, where there are indications that funds might not be used productively, it could lead to development of special resource allocation incentives or budgetary controls to accompany increased state or federal grants to districts.

This study was conducted to provide partial answers to the question, "What would school districts buy if they were given additional funds?" The focus is on school district choices among resource inputs, with greatest emphasis given to behavior in employing and compensating teachers. We have attempted to determine (a) how much of any increment in a school district's budget tends to be used to increase the teacher-pupil ratio, (b) how much goes to raise the district's salary schedule, and (c) how much is accounted for by increases in the average experience or educational level of a district's teaching force, which customarily translate into shifts to higher salary brackets within a given salary schedule. We have also investigated the effects of changes in budget levels on school district outlays for administrators and teaching specialists and for resources other than professional staff, but in less detail than we investigated spending for teachers. In addition, we have attempted to determine whether patterns of spending vary among districts in different economic circumstances or with different socioeconomic characteristics.

This study does not deal with the question of how school districts deploy, distribute, or assign their teachers or other resources. Although we were interested in understanding how programs, curricular offerings, and instructional technologies change as additional funds become available --and in the distributional question of which children benefit from budget increases--we were unable to address those questions because of the lack of relevant, comparable data for a cross-section of districts. School systems account carefully for inputs, but until very recently they have not assembled budget information by program and pupil category. Thus, we cannot report findings on, say, propensities to spend additional funds for instruction in basic skills or other areas of the curriculum or on the shares of incremental money that go to handicapped or disadvantaged pupils or to predominantly middle-class or lower-class schools. Development of state-wide school district program budgeting systems may make such data available in the future.[1] For the time being, however, information on aspects of district budget allocation other than the distribution of funds among categories of resource inputs is obtainable only from case studies of individual systems.

OVERVIEW OF THE ANALYSIS

This analysis of allocations of school district budgets among resource inputs is based on cross-sectional comparisons among Michigan school districts and uses data on Michigan districts for the 1968-69 and 1969-70 school years. These data were analyzed by two different methods, as follows:

---

[1] In a program budgeting system, expenditures are categorized by the purposes for which inputs are used, which, in the case of a school system, would include education of different kinds of pupils and instruction in different subject or program areas. See S. A. Haggart, et al., *Program Budgeting for School District Planning*, Educational Technology Publications, 1972.

Method 1: Single-Year, Cross-Sectional Analysis

The first approach was to develop statistical relationships (regression equations) among the magnitudes of interest using data for one school year at a time. Dependent variables in these equations represent budgetary outcomes. They include per pupil expenditures for teachers, administrators, specialists, and other resources; teacher-pupil and total staff-pupil ratios; teacher experience and educational level; and average teacher salary levels and salary schedule parameters. Independent variables include the size of the school budget (total current expenditure per pupil), "price" or salary variables, and selected socioeconomic characteristics of the districts. Relationships between the dependent and independent variables were explored by standard multiple regression techniques (ordinary least-squares). For each dependent variable, several alternative versions of the regression equation were derived, each of which contains a different subset of the independent variables. This made it possible to compare alternative specifications of the model and to learn about interrelationships among the school district characteristics that account for variations in budget allocations.

The analysis was carried out in a series of steps, each of which involved a progressively more detailed look at the composition of school district budgets. In step one, total expenditure per pupil was broken down into expenditure per pupil for each of the four resource categories mentioned above. Each expenditure component, in turn, was treated as the dependent variable to be related to total per pupil spending and other variables. In step two, expenditure per pupil for teachers was restated as the product of two factors: the number of teachers per pupil and the average teacher salary. Each of these factors was treated as a dependent variable to be explained. In principle, the same breakdown would have been appropriate for the administrator and specialist expenditure categories, but this proved to be unfruitful for reasons that are discussed later. Instead, the total staff-pupil ratio, which includes teachers, administrators, and specialists, was used as a dependent variable at this stage. In step three, the teacher-related variables were broken down in greater detail. Teachers are paid according to a salary schedule that rewards experience and academic training. Since salary schedules are usually linear, it is possible to summarize them with three parameters: (1) a base salary paid to a teacher with only a B.A. degree and no experience, (2) a salary increment per year of experience, and (3) a salary increment per unit of training beyond the B.A. level. A special statistical analysis was performed to estimate values of the three parameters for each district. The average salary of teachers in a district depends on the three salary schedule parameters and on average teacher experience and training. All five factors were included as dependent variables in regression equations at this stage of the analysis.

This step-by-step approach creates many opportunities for checking the internal consistency of results. For example, regression equations that have average salary and teacher-pupil ratio as dependent variables should be consistent with the equation that has their product, per pupil expenditure for teachers, as its dependent variable. Since we have data for two school years, we were able to determine the reliability and stability of results. In general, we give credence only to those findings that emerged from both the 1968-69 and 1969-70 regressions. We are also fortunate in having available the results of a similar study of budgetary allocations by California school districts, conducted at Rand by Arthur Alexander in 1974.[1] In a number of instances, direct comparisons of our results with the results of Alexander's study are possible. This provides an external test of the validity of our study's findings. We have attempted, to the extent that differences in data bases permit, to structure this analysis so that comparisons are possible between the California and Michigan results.

Method 2: Discretionary Budget Analysis

The second analytical approach is based on the concept of the "discretionary budget"--that portion of a given year's budget that is not committed to support of personnel and other resources retained by school districts from the previous year. The underlying assumption is that each Michigan district was committed in 1969-70--partly by custom and partly by tenure rules--to pay all retained teachers at least the amount called for by the 1968-69 salary schedule before considering such options as hiring additional teachers, hiring more administrators or specialists, or spending more per pupil on other resources. The discretionary budget was measured by subtracting from the actual 1969-70 budget the amount required to meet these "inherited" obligations. Since it is possible that districts exhibit similar behavior with respect to retained administrators and specialists as with respect to teachers, we considered several alternative definitions, some broad and some narrow, of the discretionary budget per pupil.

---

[1] Arthur J. Alexander, *Teachers, Salaries, and School District Expenditures*, The Rand Corporation, R-1588-FF, October 1974. Hereafter cited as Alexander.

Discretionary funds may be used to pay for any combination of the following: (a) increments in the teacher-pupil ratio, (b) increases in the level of the district's teacher salary schedule, (c) higher average levels of teacher experience and training, and (d) increments in non-teacher resources per pupil. In this method of analysis, these resource or salary increments become the dependent variables. Independent variables included the size of the discretionary budget (uncommitted expenditures per pupil), per pupil amounts of inherited resources (e.g., the number of retained teachers per pupil), base-year values of resource variables, and the same district characteristics that were used in the cross-sectional analysis. Relationships between the resource increments and these variables were derived by standard multiple regression methods. The estimates of district responses to budgetary changes obtained from this analysis were compared with those obtained from the single-year, cross-sectional regressions.

THEORETICAL PERSPECTIVE

This report is an empirical study of school district budget allocation patterns rather than an attempt to verify a completely specified theory of budgetary choice. Nevertheless, a theoretical framework has been important. In formulating empirical relationships to be investigated and in interpreting the results, we have been guided by a constrained maximization theory of school district budgetary behavior. A brief outline of the essential elements of the theoretical model is given here, and a more detailed exposition is provided in the Appendix.

The premise of the maximizing model is that district decisionmakers (administrators or school board members or both) tend to allocate their budgets as if they were trying to maximize a function of inputs into schooling. Variables that enter into the function to be maximized include numbers of teachers and other professional staff per pupil, such measures of teacher quality or qualifications as experience and training, and per pupil amounts of nonpersonnel resources. In seeking to acquire an optimal combination of these resources, the district is constrained by the amount of revenue available (current budget per pupil), by resource prices, and by institutional limits on admissible choices. This model has implications analogous to those of a standard utility maximizing model of consumer demand. The current budget per pupil, which plays the role of income in consumer demand theory, enters into the model as an exogenous variable positively associated with staffing ratios and other resource inputs. The level of teachers' salaries, if assumed to be exogenously determined, plays the role of "price" in the demand model. Other things being equal, it is expected that a higher salary level will be associated with a lower teacher-pupil ratio. It is in connection with the price variable, however, that we depart from the standard demand model. As an alternative to assuming that prices are given, we assume that they are set, at least partly, at the discretion of the district. The salary level then becomes an endogenous variable to be explained by the size of the per pupil budget and other factors. In interpreting our empirical results, we considered both the exogenous and the endogenous hypotheses of how teachers' salaries are determined.

As part of the theoretical discussion presented in the Appendix, we examine alternative, broader constrained maximization models. One possibility taken into account is that district officials seek to maximize a function of educational outcomes rather than resource inputs. We did not pursue that alternative because of the well-known difficulties of relating school district resources or expenditures to educational outcomes.

Moreover, the output maximization theory does not yield hypotheses about the effects of budget level, prices, and other district characteristics on patterns of resource allocation that are different from those of the input maximization theory. A second alternative considered is that determination of the size of the school district budget and apportionment of the budget among different resource categories are simultaneous rather than separate processes. That is, the per pupil budget cannot be treated as exogenous in analyzing budget allocations. The assumption of simultaneity implies a model in which the school district maximizes a function of either school inputs or outputs and other public and private goods consumed by district residents, all subject to a community income constraint. This model was not pursued, primarily because empirical evidence shows that separability is an empirically sound as well as an analytically convenient assumption; namely, it has been shown that the level of the total budget is determined by community wealth or tax base, the ratio of pupils to population, and other district characteristics that do not enter directly into budget allocation.

The discretionary budget model is also compatible with the constrained maximization framework, except that it incorporates one additional major element, a concept of budget adjustment derived from "habit formation" models of consumer demand. In those models (which are described in Chapter V), prior-year levels of resources are important determinants of current-year resource allocations. We have added one further refinement: To capture the effects of institutional constraints that precommit a large fraction of district funds, we assumed that current-year resource decisions depend on the level of resources retained, or inherited, from the prior year as well as on the amount of resources originally available. Similarly, we assumed that prior-year salary levels and the scheduled salaries of retained teachers affect the size of salary increments funded out of the discretionary budget.

The constrained maximization framework is incomplete in two important respects. First, it provides no theoretical basis for choosing among alternative functional forms of regression equations. The cross-sectional results presented later are all in double logarithmic form for the following reasons: (1) The log-log form yields direct estimates of budget and price elasticities. (2) The results can be compared directly with Alexander's California results, which are derived from log-log regressions. (3) It is possible to formulate consistent log-log equations for per pupil expenditure for teachers and its constituent factors, the pupil-teacher ratio and average teacher salary. (4) The log-log equations fit the data better than linear equations, which were also tested. Second, the constrained maximization theory implies certain relationships among expenditure variables, resource amounts, and prices, but says nothing about the effects of district socioeconomic characteristics on these relationships. Such variables must be included on purely empirical grounds. These shortcomings of theory are characteristic of all studies of private and public sector demand; they are by no means unique to inquiries into the behavior of public school districts.

DATA

The analysis is based on observations of all Michigan school districts with 2000 or more pupils in average daily attendance during both the 1968-69 and 1969-70 school years.[1] Data were derived from three sources: (1) a data file compiled for the Educational Assessment Program (EAP) of the Michigan Department of Education, (2) the Michigan Professional Personnel Register (PPR), and (3) the School District Data Tape for Michigan created from the 1970 Census by the National Center for Educational Statistics (NCES).

The Michigan EAP file contains data on the finances of each Michigan school district, on numbers of pupils, on teacher characteristics (district averages), and on district characteristics. It is the source of our data on per pupil spending and average teacher experience and training. The Michigan PPR file contains data on every educational professional employed in a Michigan school district, including information on training, experience, assignment, and salary. We used these data to identify the numbers of and aggregate expenditures for teachers, administrators, and specialists for each district. The PPR file also provided the data from which we were able to construct salary schedules for individual districts. The NCES School District Data Tape is a recompilation of the 1970 Census fourth count population data. It provides data tables for each school district in the country with 300 or more students. These tables were the main source of our data on demographic and socioeconomic characteristics of the districts in the Michigan sample. Since the two Michigan files cover the 1968-69 and 1969-70 school years and the 1970 Census data pertain to 1969 and 1970 population characteristics, the Michigan data represent the behavior of school districts at the time they were serving the populations measured by the Census.

---

[1] There were 205 such districts. However, data for three of the districts on the Michigan tapes could not be matched with data on the Census tapes, thereby reducing the sample to 202. For an additional seven districts, we were unable to derive satisfactory salary schedules from the data in the Professional Personnel Register. Those districts were also removed from the sample, reducing it to 195. In certain specific cases it was necessary to delete additional districts; details are given in footnotes to the affected tables.

Definitions of all variables used in the cross-sectional analyses are given at the beginnings of the chapters in which they first appear. The method used to construct salary schedule variables is explained in Chapter IV. Definitions of variables used in the discretionary budget analysis are given in Chapter V. A number of variables were considered during the analysis but were not retained in the final regression equations; these are mentioned at appropriate points in the text.

PLAN OF THE STUDY

The next three chapters present the results of the single-year, cross-sectional analysis of school district budgetary behavior. Chapter II presents findings from the regression equations in which per pupil expenditures for teachers, administrators, specialists, and other resources are the dependent variables. The main results pertain to the rate at which spending for each resource category increases with increases in total per pupil spending. Other findings concern the effects of socioeconomic characteristics of the districts on allocations of money among the four resource categories. Chapter III presents findings about the effects of variations in total spending per pupil on the two components of per pupil spending for teachers--the teacher-pupil ratio and the average level of teachers' salaries. Effects of district characteristics on the way districts trade off higher salaries against higher teacher-pupil ratios are also examined. In addition, equations similar to those used to investigate variations in the teacher-pupil ratio are fitted, using the total staff-pupil ratio as the dependent variable, and the two sets of results are compared. Chapter IV presents a more detailed analysis of the determinants of the three parameters of the teacher salary schedule--base salary, experience increment, and training increment--and the two variables that summarize teachers' positions along the schedule--average number of years of experience and average level of training. From these results, we are able to draw conclusions about the extent to which observed differences in average salaries between "richer" and "poorer" districts are attributable to better qualified teachers, higher salary schedules, and increased rewards for higher qualifications. Throughout Chapters II through IV we present results for both the 1968-69 and 1969-70 school years. The two sets of results are compared with each other and, wherever possible, with the results of Alexander's California study.

Chapters V and VI present the discretionary budget analysis. In Chapter V we develop the theoretical basis for the incremental, discretionary budget model. We present operational definitions of the measures of resource increments that serve as dependent variables in the analysis and of alternative measures of the amount of discretionary money per pupil. Chapter VI contains the discussion of the discretionary budget regression equations. These relate resource increments to the size of the discretionary budget, levels of inherited and prior-year resources, and socioeconomic characteristics of the districts.

Finally, Chapter VII summarizes the findings of the study, compares the results obtained by the two different empirical approaches, discusses areas of agreement and disagreement between the Michigan and California results, and states our principal conclusions about school district budgetary behavior.

II. EXPENDITURES FOR TEACHERS, ADMINISTRATORS, SPECIALISTS, AND OTHER RESOURCES

This chapter reports on the first of three parts of the cross-sectional analysis of school district budget allocations. The dependent variables in this set of regression equations are per pupil expenditures for teachers, administrators, specialists, and other current resources. The focus of the analysis is on how amounts spent for these four resource categories vary with the size of the district budget (current expenditure per pupil). In particular, we wish to determine whether, and at what rate, *shares* of the budget allocated for each type of resource rise or decline as the total budget increases. In addition, we are interested both in the effects of interdistrict variations in salary levels on per pupil amounts spent for teachers and other personnel and in the effects of the socioeconomic make-up of districts on patterns of fund allocation.

VARIABLES

The definitions and sources of all the variables used in this set of regression equations are given in Table 1. The first column of the table gives the symbol used to represent the variable in the regression equations. Data on total per pupil expenditure and expenditure by category are available for both the 1968-69 and 1969-70 school years. Each such variable has a three letter name followed by the digit "1" if the data are for 1968-69 or "2" if the data are for 1969-70. For example, XPT2 is a district's per pupil expenditure for teachers in 1969-70. The source of each item is indicated in the second column according to the following code: EAP = a variable from the Michigan Educational Assessment Program file; PPR = a variable constructed from the data on individual staff members in the Michigan Professional Personnel Register; and CEN = a variable from the Census School District Data Tape. Additional variables will be introduced as needed in subsequent chapters.

BIVARIATE REGRESSIONS

As a first step in analyzing the composition of district expenditure,

Table 1

VARIABLES IN THE CROSS-SECTIONAL ANALYSIS OF EXPENDITURE CATEGORIES

VARIABLE	SOURCE	DEFINITION
BUD1, BUD2	EAP	Current budget, i.e., total operating expenses per pupil
XPT1, XPT2	PPR	Total expenditures per pupil for teachers
XPA1, XPA2	PPR	Total expenditures per pupil for administrators
XPS1, XPS2	PPR	Total expenditures per pupil for specialists
XPO1, XPO2	EAP + PPR	Total expenditures per pupil for all other resources (Equals BUD-XPT-XPA-XPS)
EMPH	CEN	Ratio of high-level employment (professional technical, and kindred workers plus managers and administrators) to total employment among persons 16 years old and over
EMPM	CEN	Ratio of middle-level employment (sales, clerical, and kindred workers plus craftsmen, foremen, and kindred workers) to total employment 16 and over
CITY	CEN	Dummy variable denoting that the district includes the central city of a metropolitan area (SMSA)
BLCK	CEN	Ratio of minority persons to all persons in the district
COLL	CEN	Ratio of males (age 20-49) and females (age 15-44) with one or more years of college to all males and females in the same groups.
CLRY	CEN	Average earnings of females, 16 years old and over, in experienced civilian labor force in clerical and kindred occupations

we regressed each component of expenditure on only the budget variable. This determines the gross trend in spending patterns (not holding other factors constant) and provides a baseline for evaluating subsequent multiple regression equations.

The equations obtained by regressing each of the four expenditure components on per pupil budget only are given below. These equations were all estimated in log-log form, but are shown here in exponential form to facilitate interpretation and comparison.[1]

1968-69	1969-70
$XPT1 = 3.7BUD1^{.75}$	$XPT2 = 3.7BUD2^{.74}$
$XPA1 = .09BUD1^{.96}$	$XPA2 = .10BUD2^{.95}$
$XPS1 = 6.1x10^{-6}BUD1^{2.3}$	$XPS2 = 4.5x10^{-5}BUD2^{2.0}$
$XPO1 = .009BUD1^{1.5}$	$XPO2 = .006BUD2^{1.6}$

The most important results are those for expenditures on teachers. The elasticity of per pupil expenditure for teachers with respect to total per pupil spending is estimated from these one-variable equations to be about 0.75 (as will be seen, this value changes only slightly when other district characteristics are taken into account). That this value is less than one means that the fraction of the district budget spent on teachers tends to decline as the budget level increases. For instance, a district with the statewide average expenditure in Michigan in 1969-70, which was about $700 per pupil for our sample, would spend about $472, or 67 percent of its budget, on teachers. At the same time, low-spending and high-spending districts, with total per pupil outlays of $525 and $875, respectively, would spend about $381 and $556 per pupil for teachers, or 73 and 64 percent of their respective budgets. For comparison, Alexander obtained the very similar elasticity estimate of 0.78 in his bivariate regression of per pupil expenditure for teachers on total per pupil spending in California.[2]

---

[1] The same equations appear in later tables accompanied by the relevant statistics of error and goodness of fit.

[2] Alexander used the budget share for teachers, XPT/BUD, as his dependent variable. His univariate equation (for the school year 1971-72) is $(XPT/BUD) = kBUD^{-.218}$, which is equivalent to $XPT = kBUD^{.782}$.

Turning to the other expenditure components, per pupil outlay for administrators appears to vary almost proportionately with budget; the estimated elasticity of 0.95 is only slightly less than one. Expenditures for specialists are very sensitive to budget level; the 1969-70 elasticity estimate of 2.0 implies that specialist outlays per pupil would differ by a factor of 2.7 between the low-spending and high-spending districts cited above. Expenditures for resources other than professional personnel ("other") also increase more rapidly than total outlays; the estimated elasticity is in the 1.5 range. The close agreement in all cases between estimates for the 1968-69 and 1969-70 school years increases the confidence to be placed in these results.

MULTIVARIATE REGRESSIONS FOR TEACHER EXPENDITURES

Multiple regression equations for teacher expenditure per pupil for the 1969-70 and 1968-69 school years are presented in Tables 2 and 3. These equations relate the dependent variable to the budget level and to other variables that we had some a priori reason to believe might modify the baseline results and produce different expenditure patterns for different types of districts. Two of these additional variables represent the "price" of teachers. One is teacher starting salary (STR), which measures the level of the teacher salary schedule. Starting salary is used in preference to average salary because the latter reflects the positions of teachers along the schedule as well as the schedule itself. The other price variable is clerical income (CLRY), which is used here as a proxy for the wage level in the district in alternative occupations --the "opportunity wage" available to teachers. Five of the additional variables reflect different aspects of the socioeconomic makeup (SES) of the districts: the fractions of the district labor force in high-level (EMPH) and middle-level (EMPM) occupations (see Table 1 for definitions); the percent minority population (BLCK); a dummy variable designating central city districts (CITY); and the fraction of the adult population with some college education (COLL). Originally, we worked with a larger set of candidate variables, but many were dropped because they had insignificant or erratic effects. Combinations of the remaining ones were then tested to determine whether different variables interact or measure the

Table 2

REGRESSION EQUATIONS FOR TEACHER EXPENDITURE PER PUPIL, 1969-70

(dependent variable = log of per pupil expenditure for teachers, XPT2)

Equation	Constant	Log of Budget per Pupil (BUD2)	Log of Teacher Starting Salary (STR2)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	R^2	F
1	1.3 (6.7)	.74 (25.2)								.77	637
2	.41 (0.5)	.72 (23.6)	.11 (1.2)							.77	320
3	.46 (0.6)	.68 (21.5)	.12 (1.4)	.27 (3.9)	.14 (1.2)					.79	176
4	.38 (0.5)	.73 (19.5)	.10 (1.2)	.17 (2.2)	.03 (0.2)	-.16 (-2.2)				.79	145
5	.41 (0.6)	.79 (24.1)	.06 (0.7)			-.19 (-3.2)	-.05 (-2.0)			.79	181
6	.38 (0.5)	.75 (19.3)	.09 (1.0)	.16 (2.1)	.01 (.05)	-.13 (-1.8)	-.04 (-1.8)			.80	123
7	1.4 (4.2)	.74 (24.3)							-.02 (-0.4)	.77	317
8	.64 (0.8)	.75 (19.3)	.09 (1.1)	.17 (2.2)	.08 (0.6)	-.12 (-1.6)	-.04 (-1.7)		-.04 (-0.9)	.80	106
9	.21 (0.3)	.69 (21.3)	.15 (1.7)					.17 (3.1)		.78	226
10	.55 (0.7)	.68 (21.5)	.11 (1.2)	.42 (2.3)	.10 (0.9)			-.13 (-0.9)		.79	141

NOTE: Numbers in parentheses are t values.

Table 3

REGRESSION EQUATIONS FOR TEACHER EXPENDITURE PER PUPIL, 1968-69

(dependent variable = log of per pupil expenditure for teachers, XPT1)

Equation	Constant	Log of Budget per Pupil (BUD2)	Log of Teacher Starting Salary (STR)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	R^2	F
1	1.2 (4.9)	.75 (19.6)								.67	385
2	.75 (0.9)	.74 (18.6)	.05 (0.5)							.67	193
3	.72 (0.9)	.67 (15.8)	.10 (1.0)	.31 (3.7)	.05 (.39)					.69	105
4	.55 (0.7)	.72 (15.0)	.09 (0.9)	.21 (2.3)	-.07 (-0.5)	-.16 (-2.0)				.70	87
5	.53 (0.6)	.79 (19.4)	.05 (0.5)			-.18 (-2.5)	-.04 (-1.7)			.69	106
6	.50 (0.6)	.74 (15.1)	.08 (0.9)	.21 (2.2)	-.09 (-0.6)	-.12 (-1.5)	-.04 (-1.7)			.70	73
7	1.5 (3.8)	.76 (19.0)							-.04 (-0.9)	.67	193
8	1.5 (3.3)	.74 (15.0)	.09 (0.9)	.21 (3.3)	-.009 (-0.1)	-.11 (-1.3)	-.04 (-1.6)		-.05 (-0.9)	.70	63
9	.62 (0.7)	.68 (16.1)	.11 (1.1)					.22 (3.4)		.69	139
10	.71 (0.9)	.67 (15.7)	.10 (1.0)	.28 (1.3)	.06 (0.4)			.02 (0.1)		.69	84

NOTE: Numbers in parentheses are t values.

same thing. Only a few selected equations from the large number tested are reported in Tables 2 and 3. Negative results (no significant effect) pertaining to variables not shown in the tables are referred to briefly below.

The principal findings with respect to the socioeconomic variables are that at a given budget level spending for teachers tends to be higher in districts with large fractions of the adult population in high-level occupations (EMPH) or with college training (COLL), and lower in central city districts (CITY) or districts with large minority populations (BLCK). In both Tables 2 and 3, the effects of all SES variables except college training are captured by Eq. 6. By comparing Eq. 6 with Eqs. 3 through 5, it can be seen that there is some overlap among variables--that is, EMPH is negatively correlated with BLCK and CITY, with the result that the effect of each variable appears stronger when the variable is entered separately than when all variables are entered together. Nevertheless, independent effects of the three variables remain discernible in Eq. 6. From Eqs. 9 and 10, however, it is clear that EMPH and COLL are redundant; the positive effect of COLL when it is entered by itself (Eq. 9) washes out when it is entered together with EMPH (Eq. 10). Similarly, the effect of EMPM, which is marginally positive in Eq. 3, becomes insignificant when the stronger variables BLCK and CITY appear in the equation.

A number of other socioeconomic and price variables were tested initially but then dropped. Our prior expectation was that average family income would be the best single measure of the socioeconomic status (SES) of a district, but its effect was found to be insignificant even when entered by itself and close to zero when entered with the employment and college training variables. Other potential SES measures tested in early experiments included the fraction of families in a district with school-age children, the fraction of families below the poverty level, and the fractions of employed persons in more specific occupational categories than the high-level and middle-level classifications. As an alternative measure of the opportunity wage for teachers, we also tested average earnings of male professionals. All these variables either had no effects or their effects were subsumed by those of stronger variables that appear in the final equations.

The findings that teacher expenditure per pupil tends to increase with socioeconomic level (as measured by EMPH and COLL) and to decrease with percent minority, holding budget per pupil constant, are consistent with Alexander's results. The one important difference is that Alexander found average family income to be his best socioeconomic variable, but did not find a significant effect for occupational status.[1]

There is no a priori hypothesis about the expected sign of the coefficient of the price variable in an expenditure regression. Positive and negative signs correspond to inelastic and elastic price responses, both of which are theoretically possible. When teacher starting salary is used as the measure of price, as in Eqs. 2 through 6, the estimated coefficient is positive but only marginally significant When clerical income is used as the price measure (Eqs. 7 and 8), the coefficient is negative and again only marginally significant. We examine this apparent inconsistency later in connection with the regressions for teacher starting salary.

The estimate of the elasticity of expenditure per pupil for teachers to total budget per pupil is only slightly sensitive to the selection of socioeconomic characteristics. When EMPH, EMPM, BLCK, and CITY are all included in the regression equation, as in Eqs. 6 and 8, estimates of the budget (BUD) coefficient are nearly the same as those obtained in the bivariate equations, which reappear as Eq. 1 in Tables 2 and 3.

Total variance explained (R^2) ranges from .77 to .80 in 1969-70 and from .67 to .70 in 1968-69. The first figure in each pair is for the bivariate equation, and the second is for Eq. 6, which contains starting salary and the four SES variables. Although several variables other than budget level are significant, they contribute little to the explanatory power of the equation. It is not surprising, then, that the share of the budget spent for teachers does not vary greatly among districts with different SES characteristics. For example, according to Eq. 6, for 1969-70 the difference in per pupil spending for teachers between a district that has a value of EMPH two standard deviations above the mean and zero BLCK and a district that is two standard deviations above mean on BLCK and two below on EMPH is $37, or less than 9 percent. The tendency to increase spending for teachers at about three-fourths the rate of increase in the budget is strong.

---

[1] Alexander, 1974, p. 6.

MULTIVARIATE REGRESSIONS FOR OTHER EXPENDITURE COMPONENTS

Selected regression equations for expenditure on administrators, specialists, and other resources are presented in Tables 4 and 5. The equations for administrator and specialist outlays, which are relatively small components of school district budgets, have substantially less explanatory power (R^2) than the teacher expenditure equations or the relationships for "other" spending. Effects of the socioeconomic variables differ considerably from one category to another. The year-to-year consistency of the administrator and specialist results is not as good as for the two larger expenditure categories.

Per pupil spending for administrators tends to increase with high-level employment (EMPH) and possibly also with middle-level employment (EMPM) (Eq. A2 in Tables 4 and 5), although the effect of the latter is not significant in 1968-69. The minority population (BLCK) and central city (CITY) variables have no effect. The effect of the college training variable (COLL) is very similar to that of EMPH, just as in the teacher expenditure equations (Eq. A3, Table 4). Starting salary (STR) may have a negative effect on spending, but the coefficient of STR is not significant in 1969-70 (Eq. A2). Clerical income (CLRY) is not significant when entered in place of STR (Eq. A4, Table 4), nor is it significant in any 1968-69 equation (results not shown). The estimate of the elasticity with respect to budget level of per pupil expenditure on administrators declines from about .95 in the bivariate equation to .89 when the various SES variables are added. All those variables, in combination, add very little to the variance explained by budget level alone.

The equations for per pupil spending on specialists are partly inconsistent between the two years. The 1969-70 estimates of elasticity with respect to the per pupil budget fall from 2.0 in the bivariate equation to about 1.4 with other variables added. All four district characteristics--EMPH, EMPM, BLCK, and CITY--appear to be at least marginally

Table 4

REGRESSION EQUATIONS FOR EXPENDITURES ON ADMINISTRATORS, SPECIALISTS, AND "OTHER" RESOURCES, 1969-70

Equation	Dependent Variable	Constant	Log of Budget per Pupil (BUD2)	Log of Teacher Starting Salary (STR2)	Percent High-Level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	R^2	F
A1	log of per pupil expenditure for administrators: XPA2	-2.3 (-4.3)	.95 (11.6)								.41	135
A2		.06 (0.0)	.89 (7.8)	-.26 (-1.0)	.42 (1.8)	.78 (2.2)	.15 (0.7)	-.007 (-0.1)			.44	24
A3		-.30 (0.1)	.87 (7.7)	-.22 (-0.8)	-.17 (-0.3)	.91 (2.4)	.16 (0.8)	-.009 (-0.1)	.51 (1.2)		.44	21
A4		-2.3 (-2.0)	.84 (7.8)		.44 (1.9)	.67 (1.6)	.16 (0.7)	-.003 (-0.0)		.034 (0.3)	.43	24
S1	log of per pupil expenditure for specialists: XPS2	-10 (7.2)	2.0 (9.3)								.31	87
S2		-15 (-2.6)	1.4 (4.7)	.84 (1.3)	.80 (1.3)	1.9 (2.1)	.96 (1.8)	.38 (2.2)			.36	17
S3		-13 (2.5)	1.4 (4.8)	.70 (1.0)	2.7 (1.9)	1.5 (1.6)	.93 (1.7)	.39 (2.2)	-1.7 (1.5)		.36	15
S4		-10.6 (-3.6)	1.5 (5.3)		.60 (1.0)	1.4 (1.3)	.82 (1.5)	.34 (2.0)		.38 (1.1)	.35	17
O1	log of per pupil expenditure for "other": XPO2	-5.1 (10.0)	1.6 (20.1)								.68	402
O2		-3.5 (-1.8)	1.6 (15.5)	-.20 (-0.8)	-.54 (-2.5)	-.58 (-1.7)	.08 (0.4)	.02 (0.3)			.70	74
O3		-3.6 (-1.8)	1.6 (15.3)	-.19 (-0.8)	-.72 (-1.5)	-.54 (-1.5)	.08 (0.4)	.02 (0.3)	.16 (0.4)		.70	63
O4		-5.2 (-5.0)	1.6 (16.0)		-.52 (-2.4)	-.65 (-1.6)	.09 (0.4)	.02 (0.4)		.017 (0.1)	.70	73

NOTE: Numbers in parentheses are t values.

Table 5

REGRESSION EQUATIONS FOR EXPENDITURES ON ADMINISTRATORS, SPECIALISTS, AND "OTHER" RESOURCES, 1968-69

Equation	Dependent Variable	Constant	Log of Budget per Pupil (BUD1)	Log of Teacher Starting Salary (STR1)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	R^2	F
A1	log of per pupil expenditure for administrators: XPA2	-2.4 (-4.4)	.96 (11.4)							.40	130
A2		1.4 (4.7)	.89 (8.0)	-.40 (-1.8)	.39 (1.8)	.32 (1.0)	.08 (0.4)	.05 (0.8)		.43	23
S1	log of per pupil expenditure for specialists: XPS2	-12 (7.6)	2.3 (9.3)							.31	87
S2		-12 (-2.2)	2.3 (6.9)	-.006 (0.0)	-.70 (-1.1)	1.4 (1.5)	.35 (0.6)	.30 (1.7)		.34	16
S3		-11 (-2.1)	2.3 (7.0)	-.09 (0.1)	2.1 (1.4)	.77 (0.8)	.33 (0.6)	.32 (1.8)	-2.4 (-2.1)	.36	15
01	log of per pupil expenditure for "other": XPO2	-4.7 (-7.6)	1.5 (15.7)							.56	246
02		-3.8 (-1.8)	1.6 (13.0)	-.17 (-0.7)	-.63 (-2.6)	-.21 (-0.6)	.16 (0.7)	.02 (0.3)		.59	45

NOTE: Numbers in parentheses are t values.

significant. In 1968-69, however, the estimate of the elasticity with respect to per pupil budget remains steady at 2.3 when the other variables are added, and only CITY and EMPM have significant positive effects. Estimates of the effect of STR are also conflicting; the elasticity estimate is very close to zero in 1968-69 and it is close to one in 1969-70. The explanatory power of all these equations is quite low, and little confidence can be placed in any result other than the value of the estimated elasticity with respect to per pupil spending.

Regression equations for "other" expenditures are consistent between the two years and coefficient values tend to remain stable as additional district characteristics are added. The estimated elasticity of other expenditure per pupil with respect to budget per pupil remains nearly constant at 1.6 no matter which other variables are included. The percentage of high-level employment has a significant negative effect on the amount spent in both years; middle-level employment has a significant negative effect in 1969-70. None of the other characteristics has a significant influence. Once again, the level of total expenditure per pupil accounts for most of the explained variance by itself; differences in the other characteristics produce only minor perturbations of the expenditure pattern.

SUMMARY OF FINDINGS

Before proceeding with the next stage of the analysis, we bring together the principal findings about the allocation of district budgets among the four expenditure categories--teachers, administrators, specialists and other.

The principal findings from this set of regression equations are that (a) per pupil spending for teachers increases by about three-fourths of one percent for every one percent increase in a school district's budget; (b) per pupil spending for administrators increases slightly less than in proportion to the budget; (c) per pupil spending for specialists increases at about one and one-half times the rate of increase in total per pupil spending; and (d) per pupil spending for resources other than professional personnel increases more rapidly than any other catogory--at about 1.6 times the rate of increase in the budget. To illustrate the implications of these results, we compare for 1969-70 the patterns of spending in a district with a relatively low budget ($500 per pupil) to that of a district with a relatively high budget ($900 per pupil).[1] According to the regression equations, the lower-spending district would allocate 69 percent of its budget for teachers, 8 percent for administrators, 2 percent for specialists, and 21 percent for "other". The corresponding percentages for the higher-spending district are 60, 7, 3 and 30 percent, respectively. There is a clear pattern of declining expenditures for teachers and increasing expenditures for resources other than professional personnel as total per pupil spending rises. For policy purposes, the question of how districts behave at the margin is of primary importance. Our results imply that if the district with the $500 per pupil budget were given an additional $100 per pupil, it would spend about $51 of that amount for teachers, $6 for administrators, $4 for specialists, and $39 for other resources. In comparison, the district with the $900 per pupil budget would spend $45 of the $100 per pupil increment for teachers, $6 for administrators, $5 for specialists, and $44 for other resources. According to these figures, a larger fraction of incremental funds (e.g., additional state aid) would be used to pay teachers if the distribution of incremental funds were skewed towards lower-spending districts.

The main findings about the effects of socioeconomic variables on the expenditure pattern may be summarized as follows: School districts with higher-SES populations, as measured by either the percentage of employed persons in high-level occupations or the percentage of adults with college education, tend to spend more for teachers and administrators and less for "other" resources than lower-SES districts. Central city districts tend to spend less for teachers but more for specialists than noncity districts. Districts with high percentages of minority pupils also tend to spend less for teachers than other districts, but it is not clear what alternative use they make of the funds.

---

[1] These comparisons are based on the 1969-70 regression equations from Tables 2 and 4 that include BUD, STR, EMPH, EMPM, BLCK, and CITY as independent variables. Note: The mean value of per pupil spending in the sample districts in 1969-70 was $700.

The remainder of the cross-sectional analysis presented in Chapters III and IV, pertains only to the teacher expenditure category of the budget, a category which accounted for about 64 percent of total spending in an average Michigan district in 1969-70. No further breakdown of the administrator, specialist, and other expenditure categories was possible, primarily because of problems of data availability or quality.

III. TEACHER-PUPIL AND STAFF-PUPIL RATIOS AND AVERAGE TEACHER SALARIES

In the preceding chapter, we estimated that per pupil expenditure for teachers tends to increase by about three-quarters of one percent for every one percent increase in total per pupil spending. By definition, per pupil expenditure for teachers is the product of teacher-pupil ratio and average teacher salary. There is considerable interest, from both academic and policy standpoints, in knowing how much of the additional money available to be spent for teachers is used to increase the staffing ratio and how much is spent on higher salaries for existing staff. In this chapter, we attempt to answer the question by analyzing regression equations in which teacher-pupil ratio and average teacher salary are the dependent variables.

We wanted to examine the trade-off between numbers of staff members and average salaries for the administrator and specialist categories as well as for teachers, but this proved to be infeasible. The administrator and specialist categories cover a heterogeneous assortment of skills and assignments. There was evidence in the Michigan Professional Personnel Register files that the make-up of these categories was not comparable from one district to another. Moreover, many of the districts in our sample are so small that differences in staffing of only one or two persons can translate into large differences in administrator-pupil and specialist-pupil ratios. For the same reason, average salaries are likely to vary greatly for idiosyncratic reasons--e.g., the presence of a few staff members with many years of seniority in one district and a few younger professionals in another. For these reasons, we do not present equations with numbers or average salaries of administrators and specialists as dependent variables. However, to provide some information on how staffing ratios in the other personnel categories vary with the size of the budget, we do present equations in which the total professional staff-pupil ratio is the dependent variable and compare the results to those obtained from the teacher-pupil ratio equations.

With the exception of the dependent variables mentioned above, all variables used in this chapter are the same as in Chapter II. Symbols for the new variables are as follows: TN01 and TN02 are the numbers of teachers per pupil in 1968-69 and 1969-70, respectively; SAL1 and SAL2 are average (mean) teacher salaries in the same two years; and STF1 and STF2 are the total numbers of professional staff (teachers, administrators, and specialists) per pupil. The data on teachers and on other professionals are obtained from the Professional Personnel Register, which was described in Chapter I.

RELATIONSHIPS OF TEACHER-PUPIL RATIO AND AVERAGE TEACHER SALARY TO TOTAL SPENDING PER PUPIL

The regression equations with teacher-pupil ratio as the dependent variable for school years 1969-70 and 1968-69 are shown in Tables 7 and 8, respectively. Equations for average teacher salary in the same two years are shown in Tables 9 and 10. The most important findings from this set of equations are those concerning the rates at which budget increments translate into increments in the ratio of teachers to pupils and in average teacher pay. For convenience, these findings are summarized in Table 6. Entries in the first two columns of numbers in Table 6 are coefficients of the budget variable for selected equations from Tables 7 through 10. They represent elasticities of teacher-pupil ratio and average teacher salary with respect to total per pupil spending. For comparison, elasticities of per pupil expenditure for teachers with respect to total per pupil expenditures are also shown. These elasticities have been extracted from Tables 2 and 3. Elasticity estimates from two sets of equations for each school year are shown in Table 6. The results labeled "bivariate" are from equations in which logs of teacher-pupil ratio (TNO), average teacher salary (SAL), and per pupil expenditure for teachers (XPT), are regressed on the log of total spending per pupil (BUD). The results labeled "multivariate" are from equations in which the following additional independent variables appear: teacher starting salary (STR), percentages high-level and middle-level employment (EMPH and EMPM), percent minority (BLCK), and the dummy variable designating a central city (CITY).

Table 6

ELASTICITIES OF TEACHER-PUPIL RATIO, AVERAGE TEACHER SALARY, AND PER PUPIL SPENDING FOR TEACHERS WITH RESPECT TO THE PER PUPIL BUDGET

School Year	Equation	Elasticity with Regard to Total Expenditure per Pupil (BUD) of: Teacher-Pupil Ratio (TNO)	Average Teacher Salary (SAL)	Expenditure per Pupil for Teachers (XPT)
1969-70	Bivariate	.42	.31	.74
1969-70	Multivariate[a]	.50	.29	.75
1968-69	Bivariate	.39	.36	.75
1968-69	Multivariate[a]	.42	.36	.74

[a] Independent variables other than BUD are STR, EMPH, EMPM, BLCK, and CITY.

The main finding brought out by Table 6 is that a somewhat larger share of a given percentage increment in per pupil spending translates into an increased teacher-pupil ratio than into higher pay for teachers. For example, according to the bivariate estimates for 1969-70, a one percent increase in BUD is associated with a .42 percent increase in teacher-pupil ratio and a .31 percent increase in average teacher salary. Estimates from the multivariate equations for 1969-70 show a larger difference between the two rates of increase--a budget elasticity of .50 for teacher-pupil ratio and an elasticity of .29 for average pay. According to the 1968-69 results, however, the teacher-pupil ratio increases at only a slightly higher rate than average salary as the budget becomes greater. The respective elasticities are .39 and .36 according to the bivariate equation and .42 and .36 according to the multivariate estimates. The 1969-70 and 1968-69 estimates of rates at which teacher-pupil ratio and average teacher salary increase with the size of the budget are not fully consistent, although all estimates confirm that teacher-pupil ratio tends to increase more rapidly.

Since per pupil expenditure for teachers (XPT) equals teacher-pupil ratio (TNO) multiplied by average salary (SAL), the elasticity of XPT

Table 7

REGRESSION EQUATIONS FOR TEACHER-PUPIL RATIO, 1969-70

(dependent variable = log of teacher-pupil ratio, TNO2)

Equation	Constant	Log of Budget per Pupil (BUD2)	Log of Teacher Starting Salary (STR2)	Log of Average Teacher Salary (SAL2)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	R^2	F
1	-5.9 (-26.1)	.42 (12.2)									.44	148
2	-4.5 (-5.2)	.50 (10.7)	-.20 (-2.0)		.08 (0.9)	-.36 (-2.4)	-.17 (-2.0)	-.06 (-2.1)			.50	31
3	-4.8 (-10.8)	.49 (11.2)			.15 (1.6)	-.07 (-0.4)	-.11 (-1.3)	-.05 (-1.7)		-.18 (-3.4)	.52	34
4	-3.4 (-3.7)	.51 (11.3)	-.19 (-1.9)		.12 (1.3)	-.04 (-0.2)	-.12 (-1.4)	-.05 (-1.9)		-.18 (-3.4)	.53	30
5	-4.4 (-5.0)	.47 (10.4)	-.22 (-2.1)				-.10 (-1.3)	-.05 (-1.9)	.15 (1.6)		.49	36
6	-4.4 (-4.9)	.50 (10.6)	-.21 (-2.0)		.11 (0.6)	-.37 (-2.3)	-.17 (-1.9)	-.06 (-2.1)	-.04 (-0.2)		.50	27
7	-.08 (-0.1)	.68 (17.1)		-.81 (-9.4)							.61	151
8	-.14 (-0.2)	.71 (16.1)		-.83 (-9.6)	.15 (1.9)	-.05 (-0.4)	-.14 (-1.9)	-.05 (-2.0)			.66	60

NOTE: Numbers in parentheses are t values.

Table 8

REGRESSION EQUATIONS FOR TEACHER-PUPIL RATIO, 1968-69

(dependent variable = log of teacher-pupil ratio, TN01)

Equation	Constant	Log of Budget per Pupil (BUD1)	Log of Teacher Starting Salary (STR1)	Log of Average Teacher Salary (SAL1)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	R^2	F
1	-5.7 (-21.9)	.39 (9.6)									.32	93
2	-3.8 (-4.5)	.42 (8.5)	-.23 (-2.3)		.24 (2.5)	-.31 (-2.1)	-.17 (-2.1)	-.05 (-1.9)			.45	25
3	-4.8 (10.7)	.40 (8.5)			.28 (3.0)	-.14 (0.8)	-.14 (-1.7)	-.04 (-1.6)		-.11 (-2.1)	.45	25
4	-3.1 (-3.5)	.43 (8.8)	-.22 (-2.2)		.26 (2.8)	-.11 (-0.7)	-.15 (-1.8)	-.05 (-1.7)		-.11 (-2.1)	.46	23
5	-3.7 (-4.4)	.39 (8.5)	-.23 (-2.3)				-.11 (-1.5)	-.05 (-1.8)	.26 (3.8)		.45	31
6	-3.8 (-4.6)	.42 (8.5)	-.22 (-2.2)		-.12 (-0.6)	-.22 (-1.5)	-.17 (-2.1)	-.05 (-1.9)	.31 (1.8)		.46	22
7	-1.4 (-2.0)	.61 (11.8)		-.61 (-6.1)							.44	74
8	-1.9 (-2.7)	.58 (10.3)		-.54 (-5.5)	.23 (2.6)	-.20 (-1.4)	-.14 (-1.9)	-.05 (-1.8)			.51	33

NOTE: Numbers in parentheses are t values.

with respect to total per pupil spending (BUD) should be equal to the sum of the elasticities of TNO and SAL with respect to BUD.[1] The bivariate estimates satisfy this condition almost exactly (e.g., the TNO and SAL elasticities for 1969-70 sum to .73, while the XPT elasticity is .74); the multivariate results satisfy it approximately (e.g., the TNO and SAL elasticities for 1969-70 sum to .79, while the XPT elasticity is .75). This shows that the regression equations for teacher-pupil ratio and average teacher salary are reasonably consistent with the expenditure equations of Chapter II.

The extent to which teacher-pupil ratio and average teacher salary vary with the budget level may be illustrated numerically. According to the 1969-70 multivariate estimates, teacher-pupil ratios in districts with low, average, and high levels of spending ($525, $700, and $875) would have been .037, .043, and .048, respectively, assuming mean values of all other independent variables. Stated in more familiar terms, these correspond to pupil-teacher ratios of 27.0, 23.3, and 20.8. The estimated average teacher salary levels in the same three districts would have been $9,564, $10,432, and $10,692, respectively. According to the 1968-69 estimates, however, there would have been less interdistrict variation in teacher-pupil ratio and more in average salary.

REGRESSION EQUATIONS FOR TEACHER-PUPIL RATIO

Selected regression equations with teacher-pupil ratio as the dependent variable are presented in Tables 7 and 8. The effects of variations in total per pupil spending on teacher-pupil ratio have already been discussed. It can be seen from these two tables that estimates of these effects are influenced only slightly either by adding other independent variables to the equation or deleting them from the equation. The equations containing average salary as an independent variable (Eqs. 7 and 8 in Tables 7 and 8) appear to be exceptions, but they require special interpretation and are discussed later. Effects on the teacher-pupil ratio of independent variables other than BUD are discussed in the following paragraphs.

---

[1] The elasticity of XPT with respect to BUD is defined as $\frac{d(XPT)}{d(BUD)} \frac{BUD}{XPT}$, and the elasticities of TNO and SAL with respect to BUD are defined as $\frac{d(TNO)}{d(BUD)} \frac{BUD}{TNO}$ and $\frac{d(SAL)}{d(BUD)} \frac{BUD}{SAL}$, respectively. Since XPT = TNO x SAL, $\frac{d(XPT)}{d(BUD)} = TNO \frac{d(SAL)}{d(BUD)} + SAL \frac{d(TNO)}{d(BUD)}$. Multiplying both sides by $\frac{BUD}{XPT}$ and making use of the foregoing identity, $\frac{d(XPT)}{d(BUD)} \frac{BUD}{XPT} = \frac{d(SAL)}{d(BUD)} \frac{BUD}{SAL} + \frac{d(TNO)}{d(BUD)} \frac{BUD}{TNO}$, which is the stated summation rule for the two elasticities.

Effects of Price Variables

An important finding is that the teacher-pupil ratio in a district is negatively related to salary level, in accordance with theory. When teacher starting salary (STR) is entered into the regressions as an independent price variable, the estimated price elasticity is about -.20. Very similar estimates are obtained from the 1969-70 and 1968-69 cross sections. The STR coefficient is always significant, and its value is affected only very slightly by addition or deletion of other variables. It is not surprising that teacher-pupil ratio and starting salary are negatively related. Starting salary and average salary are positively correlated. Other things being equal, a district with a high starting salary will be able to employ fewer teachers per pupil than another district with the same budget and a low starting salary. That is not the whole story, however. If the negative relationship reflected nothing but a trade-off between teacher-pupil ratio and salary level, we would expect an elasticity of approximately -1.0--i.e., a given percentage increase in salary would be associated with the same percentage decrease in teacher-pupil ratio, keeping the total outlay for teachers constant. But in fact, the elasticity is much less negative--only about -0.2. This means that higher salary levels tend to be only partly offset by reductions in the teacher-pupil ratio. The remainder of the higher cost of teachers must be compensated for by reduced purchases of other resources. In Chapter II we found that total spending for teachers was positively associated with starting salary, but that the coefficient was only marginally significant. The results shown in Tables 7 and 8 constitute stronger evidence of the price inelastic nature of school districts' demands for teachers.

An alternative specification, based on the concept of an opportunity wage for teachers, makes use of the income of clerical workers in the district (CLRY) as a proxy for salary level. When CLRY is used instead of STR (Eq. 3 in Tables 7 and 8), a significant negative coefficient is also obtained. However, the estimated elasticity is not the same for both years. It is -.18 in 1969-70 and -.11 in 1968-69. When both STR and CLRY are included in the equations (Eq. 4 in Tables 7 and 8), both the coefficient and the t-value of each variable remain virtually the same as when each variable is entered separately. This suggests that clerical income may not be serving as a proxy for teacher salary but may be measuring some other attribute of the district, perhaps some aspect of its socioeconomic make-up. The relationship between STR and CLRY is further explored in Chapter IV.

Effects of Socioeconomic Characteristics

Other things being equal, teacher-pupil ratios tend to be smaller in central city districts and districts with larger numbers of minority pupils. Also, the teacher-pupil ratio seems to be negatively related to the fraction of the labor force in middle-level occupations. This effect appears significant only in certain formulations of the regression equation, however. The 1968-69 results also show a tendency for the teacher-pupil ratio to be higher in districts with above-average values of high-level employment, but that result is only weakly confirmed by the 1969-70 estimates. The redundancy of the college education variable and the high-level employment variable as indicators of socioeconomic status is demonstrated by the results obtained in Eqs. 4 through 6 in Tables 7 and 8: The t-value of either variable is sharply reduced when the other variable is added to the equation. The total fraction of variance in teacher-pupil ratio (R^2) explained by the regressions is about .50 in 1969-70 and .45 in 1968-69. The budget variable alone accounts for 90 percent of the explained variance in 1969-70, but it accounts for a considerably smaller amount in 1968-69. We have no explanation for the apparently greater explanatory power of the other variables in the earlier year.

Comparison with California Estimates

A comparison with Alexander's equations for teacher-pupil ratio in California in 1971-72 reveals some areas of agreement and some of conflict. His estimate of the elasticity of the teacher-pupil ratio with respect to budget is somewhat higher than ours. His is .55 to .60,[1] depending on the specific form of the equation, and ours is .40 to .50. Some of this difference may be explainable by the absence of a distinction between teachers and specialists in the California work. Since expenditures for specialists increase rapidly with budget increases, the budget elasticity of the ratio of teachers plus specialists to pupils would be higher than the budget elasticity of the teacher-pupil ratio alone. Alexander also estimates a much stronger price response--his estimate of price elasticity is about -.80; ours is -.20. Interestingly, however, his estimate falls to -.34 when the number of pupils in the district is entered as an independent variable.[2] This suggests a possible explanation. One respect in which Alexander's analysis differs from ours is that he includes districts as small as 300 pupils while we exclude all with fewer than 2000. In very small districts, salaries tend to be low because these districts usually are rural, and teacher-pupil ratios tend to be high because of the indivisibilities associated with the small number of pupils at each grade level. It is possible that this negative relationship is reflected in Alexander's elasticity estimate. This is strictly a conjecture, however; we have no way of knowing by how much the California elasticity estimate would be altered by deletion of small districts from the sample.

There are also differences between Alexander's findings and ours regarding the effects of socioeconomic variables on the teacher-pupil ratio. Contrary to our results, Alexander finds a negative relationship between the teacher-pupil ratio and such indicators of high socioeconomic level as family income, percent of people in professional occupations, and percent of people with high school and college educations. He finds that the teacher-pupil ratio is smaller in city districts than in other districts, which agrees with our result. He does not include the variable percent minority in his equations for teacher-pupil ratio.

---

[1] Alexander, 1974, p. 11, Table 3.

[2] Ibid., Table 3, Eq. 9.

In sum, there are minor differences between Alexander's results and ours regarding the relationship between teacher-pupil ratio and budget level, but these may not be significant when differences in definition and Alexander's inclusion of small districts are taken into account. There are definite conflicts, however, between the findings of the two studies about relationships between teacher-pupil ratio and both price and SES variables. Therefore, no basis has been established for generalizing the results of either study outside the state in which the study was conducted.

REGRESSION EQUATIONS FOR AVERAGE TEACHER SALARY

The regression equations in which average teacher salary is the dependent variable are shown in Tables 9 and 10. These equations are only of secondary interest since more detailed equations for the components of average salaries will be presented in Chapter IV. They are also potentially misleading because variations in average salaries reflect the combined effects of variations in salary schedules and in positions of teachers along the schedule. Nevertheless, the main findings are given here.

We have already noted that estimated elasticities of average salaries with respect to total per pupil spending are on the order of .36 according to the 1968-69 equations and .30 according to the 1969-70 equations. These values are only slightly affected by incorporation of other independent variables into the equations (except for teacher-pupil ratio, which we discuss below). The budget variable alone accounts for approximately 90 percent of all variance explained in 1968-69 and for a slightly smaller fraction of variance explained in 1969-70.

There is a positive relationship between average salary and the level of clerical income (CLRY) in a district. This is consistent with the opportunity wage hypothesis. However, the elasticity of average salary with respect to CLRY is lower than the hypothesis would lead one to expect, and the 1968-69 and 1969-70 estimates of its magnitude are inconsistent. Relationships between the individual components of average salary and CLRY are investigated in Chapter IV.

Table 9

REGRESSION EQUATIONS FOR AVERAGE TEACHER SALARY, 1969-1970

(dependent variable = log of average teacher salary, SAL2)

Equation	Constant	Log of Budget per Pupil (BUD2)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minor-ity (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	Log of Teacher Pupil Ratio (TNO2)	R^2	F
1	7.2 (46.0)	.31 (13.1)								.47	170
2	7.2 (38.7)	.29 (9.6)	.05 (0.7)	.41 (4.0)	.03 (0.4)	.009 (0.4)				.51	40
3	6.1 (23.9)	.28 (11.9)						.17 (5.6)		.54	114
4	6.2 (20.2)	.28 (9.4)	.02 (0.2)	.16 (1.3)	-.01 (-0.2)	.002 (0.1)		.14 (3.9)		.55	38
5	4.5 (15.3)	.43 (15.7)						.11 (3.9)	-.34 (-8.2)	.66	125
6	4.4 (13.3)	.46 (14.3)	.07 (1.3)	.13 (1.3)	-.05 (-1.1)	-.02 (-0.9)		.07 (2.3)	-.38 (-8.9)	.68	58
7	6.0 (23.0)	.30 (10.2)			-.06 (-1.1)	-.001 (-0.1)	-.06 (-0.9)	.16 (5.3)		.55	46
8	6.4 (19.1)	.29 (9.5)	.17 (1.3)	.11 (0.8)	-.02 (-0.2)	.003 (0.1)	-.02 (-1.3)	.14 (3.8)		.55	33

NOTE: Numbers in parentheses are t values.

Table 10

REGRESSION EQUATIONS FOR AVERAGE TEACHER SALARY, 1968-69

(dependent variable = log of average teacher salary, SAL1)

Equation	Constant	Log of Budget per Pupil (BUD1)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	Log of Teacher Pupil Ratio (TNO1)	R^2	F
1	6.9 (40.4)	.36 (13.7)								.49	188
2	6.8 (34.2)	.36 (10.9)	-.07 (-1.0)	.26 (2.6)	.05 (0.8)	.004 (0.2)				.52	41
3	6.2 (23.8)	.34 (12.4)						.095 (3.1)		.52	103
4	6.3 (20.0)	.35 (10.6)	-.08 (-1.2)	.14 (1.1)	.03 (0.5)	.00 (0.0)		.071 (1.9)		.53	35
5	5.1 (15.8)	.44 (14.1)						.061 (2.1)	-.25 (-5.6)	.59	90
6	5.1 (13.6)	.45 (12.4)	-.01 (-0.1)	.10 (0.9)	-.006 (-0.1)	-.01 (-0.6)		.042 (1.2)	-.25 (-5.3)	.59	38
7	6.3 (23.6)	.37 (11.3)			.001 (0.0)	-.001 (-0.0)	-.15 (-2.3)	.084 (2.7)		.53	43
8	6.5 (19.2)	.36 (10.7)	.11 (0.8)	.07 (0.6)	.029 (0.5)	.001 (0.0)	-.24 (-1.7)	.067 (1.8)		.54	31

NOTE: Numbers in parentheses are t values.

Effects of the socioeconomic variables on average teacher salary are weak and ambiguous. The fraction of high-level employment in a district (EMPH) appears positively related to average salary in Eq. 2 of Tables 9 and 10, but becomes insignificant when CLRY is added to the equation. The fraction of adults with college education (COLL), which behaved in the same way as EMPH in the expenditure regressions presented in Chapter II, now appears to work in the opposite direction; however, it is only marginally significant in the 1969-70 equations. The central city and percent minority variables have no effects whatsoever--a somewhat surprising finding in view of the arguments frequently advanced about high central city costs and the difficulty of attracting teachers to central city teaching assignments. In Chapter IV we investigate the possibility that this result reflects offsetting effects of the central city variable on teacher qualifications and salary schedule parameters. Alexander did not present equations containing average teacher salary as the dependent variable; therefore, no comparison of our findings with California results is possible.

The extent to which school districts treat teacher-pupil ratio (TNO) and average teacher salary (SAL) as substitutes is illustrated by the equations for teacher-pupil ratio that include SAL as an independent variable (Eqs. 7 and 8 in Tables 7 and 8) and the equations for average salary that include TNO as an independent variable (Eqs. 5 and 6 in Tables 9 and 10). The strong negative relationship between the two variables is underscored by the high t-values associated with these coefficients. There is also a distinct asymmetry in the results: When SAL has a high value for reasons unrelated to the budget level, the extra cost of high-salaried teachers is mainly compensated for by a decrease in the teacher-pupil ratio (i.e., the SAL coefficients in Tables 7 and 8 are -.6 to -.8). When TNO is high, however, the extra cost is offset to a much smaller degree by smaller average salaries (i.e., the TNO coefficients in Tables 9 and 10 are only on the order of -.25 to -.35). A possible reason for the asymmetry, which is supported by results reported in Chapter IV, is that a district has much less control over the components of average salary--teacher qualifications and the level of the salary schedule--than it has over the teacher-pupil ratio. The equations referred to in this paragraph are not acceptable explanatory equations because the added variables, TNO and SAL, are endogenous. They depend strongly on the level of per pupil spending (BUD). This means that the coefficients of BUD, as well as the coefficients of TNO and SAL themselves, will be seriously biased when either TNO or SAL is included on the right-hand side of a regression equation.

REGRESSION EQUATIONS FOR STAFF-PUPIL RATIO

The staff-pupil ratio (STF) is defined as the total number of teachers, specialists, and administrators divided by the number of pupils. Since teachers make up most of the staff, it is nor surprising that the regression equations for staff-pupil ratio and for teacher-pupil ratio are very similar. However, inspection of the staff-pupil regressions shown in Tables 11 and 12 and comparison of them with the teacher-pupil equations in Tables 7 and 8 reveals two significant differences. The first difference is that the estimated elasticity of staff-pupil ratio with respect to budget is higher than elasticity of teacher-pupil ratio with respect to budget in both years--i.e., total staff increases more rapidly than teaching staff as the budget becomes larger. As noted earlier, this primarily reflects the rapid increase in spending for specialists as per pupil expenditure rises. To a lesser extent, it also reflects the nearly proportional increase in spending for administrators as the budget rises, as compared with only three-fourths as rapid a rate of increase in expenditure for teachers. The estimates of elasticities of staff-pupil ratios with respect to budget are .49 and .55 for 1968-69 and 1969-70, respectively; these compare with estimates of .42 and .50 for the corresponding elasticities of teacher-pupil ratios. The response of the teacher-pupil ratio alone to increases in per pupil outlays tends to understate the degree to which budget increments translate into increases in a district's complement of professional educators. The second difference is that the proportions of variance explained (R^2) are higher for the staff-pupil ratio equations than for the corresponding teacher-pupil ratio relationships. This is by no means a logical consequence of the higher elasticity estimates for staff-pupil ratio. In fact, given the relatively low R^2 values reported in the equations for administrator

Table 11

REGRESSION EQUATIONS FOR STAFF-PUPIL RATIO, 1969-70

(dependent variable = log of staff-pupil ratio, STF2)

Equation	Constant	Log of Budget per Pupil (BUD2)	Log of Teacher Starting Salary (STR2)	Log of Average Teacher Salary (SAL2)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	R^2	F
1	-6.3 (-30.3)	.50 (15.7)									.56	246
2	-4.6 (5.6)	.55 (12.8)	-.23 (2.3)		.07 (0.8)	-.27 (-2.0)	-.12 (-1.5)	-.03 (-0.8)			.60	47
3	-5.2 (-12.4)	.54 (13.3)			.14 (1.6)	-.003 (-0.0)	-.06 (-0.8)	-.02 (-0.8)		-.17 (-3.5)	.61	49
4	-3.5 (-4.2)	.57 (13.4)	-.21 (-2.3)		.12 (1.3)	.025 (0.2)	-.08 (-0.9)	-.02 (-0.9)		-.17 (-3.4)	.62	44
5	-4.5 (-5.5)	.53 (12.7)	-.24 (-2.4)				-.07 (-1.0)	-.03 (-1.1)	.13 (1.5)		.59	55
6	-4.5 (-5.4)	.56 (12.6)	-.23 (-2.3)		.09 (0.5)	-.28 (-1.9)	-.12 (-1.5)	-.03 (-1.2)	-.02 (-0.1)		.60	40
7	-.43 (-0.8)	.76 (21.8)		-.82 (-10.8)							.73	254
8	-.32 (-0.5)	.77 (19.5)		-.84 (-11.0)	.14 (2.0)	.03 (0.3)	-.09 (-1.4)	-.02 (-0.9)			.75	93

NOTE: Numbers in parentheses are t values.

Table 12

REGRESSION EQUATIONS FOR STAFF-PUPIL RATIO, 1968-69

(dependent variable = log of staff-pupil ratio, STF1)

Equation	Constant	Log of Budget per Pupil (BUD1)	Log of Teacher Starting Salary (STR1)	Log of Average Teacher Salary (SAL1)	Percent High-Level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Percent College Educated (COLL)	Log of Clerical Income (CLRY)	R^2	F
1	-6.1 (-25.6)	.47 (12.7)									.45	160
2	-3.6 (-4.7)	.49 (10.9)	-.29 (-3.1)		.21 (2.5)	-.25 (-1.9)	-.14 (-1.9)	-.02 (1.0)			.55	38
3	-5.1 (12.2)	.47 (10.6)			.27 (3.1)	-.08 (-0.5)	-.11 (-1.4)	-.02 (-0.6)		-.12 (-2.4)	.54	36
4	-2.9 (-3.6)	.51 (11.2)	-.28 (-3.1)		.24 (2.7)	-.06 (-0.4)	-.11 (-1.5)	-.02 (-0.8)		-.11 (-2.3)	.56	34
5	-3.5 (-4.6)	.47 (11.1)	-.29 (-3.2)				-.09 (-1.3)	-.02 (-0.9)	.23 (3.6)		.55	46
6	-3.7 (-4.8)	.49 (10.9)	-.28 (-3.1)		-.09 (-0.4)	-.18 (-1.3)	-.14 (-1.9)	-.03 (-1.0)	.26 (1.7)		.55	33
7	-1.8 (-2.7)	.69 (14.9)		-.63 (-7.0)							.56	124
8	-2.1 (-3.2)	.65 (12.7)		-.56 (-6.4)	.21 (2.6)	-.15 (-1.2)	-.11 (-1.6)	-.02 (-0.9)			.61	49

NOTE: Numbers in parentheses are t values.

and specialist expenditures (Tables 4 and 5) as compared with the R^2s for teacher expenditure equations, the opposite result might have been expected. The implication is that one can predict with slightly greater confidence the degree to which districts will tend to spend money for all professional staff than for teachers only. Districts are more consistent in expending budget increments for additional staff than in dividing up those expenditures among the teacher, specialist, and administrator categories.

Other results of the regressions for staff-pupil ratio are very similar to those of the teacher-pupil equations. The negative price effect appears clearly when either starting salary or clerical income is used as the price measure. Note that in this context teacher starting salary (STR) is used as a proxy for salaries of all professional staff, including specialists and administrators. This does not degrade the results; in fact, t-values of the STR coefficients are larger in the STF than in the TNO equations. There is only one noteworthy difference between the two sets of equations in findings concerning the effects of the SES variables: the central city variable (CITY), which was significantly negative in the teacher-pupil ratio equations, ceases to be significant in the staff-pupil ratio equations. This implies that the tendency of central city districts to employ fewer teachers than other districts with comparable budgets is offset by their employment of more administrators and specialists.

SUMMARY OF FINDINGS

The principal findings of this chapter concern the extent to which increases in per pupil spending for teachers translate into increases in the number of teachers per pupil, on one hand, and into increases in the average salary of teachers, on the other. The regression results for both the 1969-70 and 1968-69 school years show that the elasticity of teacher-pupil ratio with respect to spending is larger than the elasticity of average salary with respect to spending; however, the two sets of results are not in agreement about the relative magnitudes. According to the 1969-70 results, the teacher-pupil ratio increases by 5 percent for each 10 percent increase in budget, while average teacher salary increases by only 2.9 percent. According to the 1968-69 results, the two rates of increase are much closer together--4.2 percent and 3.6 percent, respectively.

To illustrate the implications of the results, consider a school district in which all independent variables are initially at their mean value (total expenditure per pupil equals $700 per year). If such a district were given an additional $100 per pupil, approximately $48 more per pupil would be spent on teachers. According to the 1969-70 estimates, about 57 percent of the $48 increase would be accounted for by an increase in the teacher-pupil ratio; about 41 percent would be accounted for by an increase in the average salary of the existing teaching force. The remaining 2 percent would be accounted for jointly--i.e., it would represent the cost of applying the increase in average salary to the salaries of the newly added teachers. There is a slight tendency for a larger share of the increment in spending for teachers to be used for salary increases in wealthier districts. In a district with a $900 initial budget level, for example, 55 rather than 57 percent of the increment in teacher outlays would go for increases in teacher-pupil ratio, and 42 percent rather than 41 percent would go for increased salaries.

The teacher-pupil ratio of a school district is found to be price-inelastic--that is, the ratio falls by only two-tenths of one percent in response to a one percent increase in starting salary. This is consistent with the finding reported in Chapter II that per pupil spending for teachers is positively related to starting salary.

The main effect of the socioeconomic variables is that teacher-pupil ratios tend to be lower in central city districts and districts with large concentrations of minority pupils. These lower teacher-pupil ratios are not offset by higher average salaries, however. Rather, as reported in Chapter II, the funds saved by having more pupils per teacher are used to buy resources other than teachers. The other socioeconomic variables have only weak or inconsistent effects in this set of equations. Therefore, no definite findings can be reported about the relationships of teacher-pupil ratio and average teacher salary to the general socioeconomic level of the community.

IV. THE DETERMINANTS OF TEACHER SALARIES

As was explained earlier, an analysis that focuses on average teacher salaries gives an incomplete and possibly misleading picture of the relationship between the size of the district budget and the level of teachers' pay. The reason is that the average salary level in a district depends on both the salary schedule and the distribution of teachers among the various cells within it. The salary schedule relates teacher pay to experience and educational attainment. Average salary can increase even if the entire pay scale remains fixed if on the average a district's teachers become more experienced, if their average educational attainment goes up, or if the district hires new teachers with more training or experience than the teachers they replace. Specifically, average salary can be expressed as the sum of three terms:

$$\begin{array}{l}\text{Average}\\ \text{Salary}\end{array} = \begin{array}{l}\text{Starting salary,}\\ \text{B.A., no}\\ \text{experience}\end{array} + \left(\begin{array}{l}\text{Average}\\ \text{experience}\\ \text{(years)}\end{array} \times \begin{array}{l}\text{Salary increment}\\ \text{per year of}\\ \text{experience}\end{array}\right)$$

$$+ \left(\begin{array}{l}\text{Average educational}\\ \text{attainment beyond}\\ \text{B.A. degree}\end{array} \times \begin{array}{l}\text{Salary increment}\\ \text{per unit of}\\ \text{educational experience}\end{array}\right)$$

Policymakers are likely to attach different significance to salary increases that result from an upgrading of the average experience and training of the teaching force than to increases attributable wholly to upward movement of the salary schedule. Also, pay increases that result from a uniform upward movement of the entire pay scale may be assessed differently than those caused by changes in the rewards paid to more experienced or more extensively trained teachers. Therefore, it is important to go beyond average salary and to examine the behavior of the five individual factors that jointly account for average salary levels.

VARIABLES

Teacher Experience and Training

An analysis of interdistrict variations in average teacher experience and average teacher training can be carried out with little difficulty. The necessary data appear in the Michigan Professional Personnel Register (PPR) files. It was a simple matter to compute district-level averages from the data on individual teachers in each district. There is one important data limitation, however: Information on teacher training is confined to degree level. We know whether a teacher's highest degree is a B.A., M.A., or Ph.D., but data that would permit a finer classification, e.g., by units of coursework completed, are not available. Since the number of teachers with doctorates is negligible, our analysis of the teacher training variable focuses on the percentage of teachers with M.A. degrees. Accordingly, the two teacher characteristics that appear as dependent variables in the regression equations are (1) the average (mean) number of years of experience of teachers in a district, symbolized by AXP, and (2) the percentage of a district's teachers with M.A. degrees, symbolized by PCM.

Salary Schedule Parameters

Analysis of interdistrict variations in salary schedules is more difficult. Values of the three parameters that summarize a district's salary schedule--starting salary, experience increment, and education increment--do not appear in any data file. They must be estimated from detailed salary schedule information. We faced two problems in attempting to make these estimates. First, salary schedules for Michigan school districts were not available in machine readable form. Therefore, we found it necessary to construct approximate salary schedules ourselves, using data on salaries and characteristics of individual teachers from the PPR file. Second, salary schedules, even where available, are not expressed in a form that permits the summary parameters to be measured directly. A typical salary schedule is a two-dimensional matrix in which rows correspond to year of experience, columns correspond to educational level (measured by numbers of credit hours or degrees received or both[1]), and the entry in each cell is the salary paid to a teacher having that combination of experience and education. Values of the three summary parameters must be determined statistically from the data in the salary matrix. Alexander, in his California study, faced the second of these problems but not the first. He needed to estimate the salary schedule parameters statistically, but had actual district salary schedules to work with. Our need to reconstruct salary schedules introduces an additional source of error into the estimation procedure. Because the information on educational attainment in the PPR file is incomplete, the reconstructed schedules are inexact and the resulting parameter estimates are cruder than Alexander's. Nevertheless, the methodologies of the two studies, except for the initial step, are very similar.

Reconstruction of Salary Schedules. The Michigan PPR data include salary, years of experience, and degree level for each teacher in each district. To construct a district salary schedule from these data, we sorted teachers into categories according to both experience and degree. As already mentioned, the PPR file does not contain finer information on educational attainment. That is, a teacher with a B.A. plus 18 credit hours of graduate courses is classified simply as a teacher with a B.A. and is indistinguishable from a teacher with a B.A. and no additional coursework. This means that we were unable to sort teachers into all the educational attainment categories that appear in official salary schedules. Stated differently, we had to collapse all columns of the salary schedule pertaining to teachers with a given highest degree into a single column. When sorting was completed, we found that the numbers of teachers with either Ph.D. degrees or no degree (less than a B.A.) were so small that those educational levels could be neglected. Therefore, in the sorting operation we made distinctions only between teachers with B.A. and M.A. degrees and among teachers with different levels of experience within those two categories. For each of these cells, we took the mean salary of all teachers in the cell as the scheduled salary payable to teachers with that experience and degree combination.

---

[1] E.g., there might be columns for B.A. degree, B.A. + 15 units, B.A. + 30 units, M.A., M.A. + 15 units, and so forth.

Estimation of Parameter Values. In order to estimate salary schedule parameters from the schedules we constructed, it is necessary to assume that salary is a linear function of experience and training. Many district schedules actually appear to be laid out according to a simple linear rule. For example, a teacher with no experience and a B.A. degree may start at $7000 and the schedule may provide for an increase of $400 for each year of experience and an additional $50 for each credit hour of coursework beyond the B.A. degree. Such a schedule is perfectly linear over the range of experience and education for which rows and columns are specified; the experience and educational increments are constant and additive. Typically, however, there is a maximum number of experience increments that can be obtained by a teacher with a given educational level--i.e., there is an upper bound on the experience factor. For example, the schedule may provide increments of $400 per year up to a maximum of 15 years, after which additional seniority brings no further reward. Such a schedule can be described by four parameters: starting salary, the education and experience increments, and the maximum experience increment payable to a teacher with experience greater than the schedule's upper bound. Taking into account our limited ability to distinguish different levels of training, an algebraic representation of the schedule is

$$S(YRS,MA) = STR + EXP \cdot YRS \cdot (1 - \delta) + DEG \cdot MA + TOP \cdot \delta,$$

where

YRS = number of years of experience,

MA = a dummy variable denoting that a teacher has an M.A. degree (MA = 1 if the teacher has the degree; MA = 0 otherwise),

δ = a dummy variable denoting that a teacher is at the maximum seniority level (δ = 1 if teacher's experience equals or exceeds the maximum; δ = 0 otherwise),

STR = starting salary for a teacher with a B.A. degree and no experience,

EXP = the salary increment per year of experience,
DEG = the salary increment for an M.A. degree,
TOP = the maximum experience increment,
S(YRS, MA) = the salary of a teacher with experience and training equal to YRS and MA, respectively.

Note that for all teachers not yet at the experience ceiling, the above equation takes on the straightforward linear form

$$S(YRS,\ MA) = STR + EXP \cdot YRS + DEG \cdot MA,$$

and for teachers at or above the ceiling, it becomes

$$S(YRS,\ MA) = STR + DEG \cdot MA + TOP.$$

Using multiple regression analysis, we estimated values of the four parameters--STR, EXP, DEG, and TOP--for each of the 202 districts in the sample.[1] The extent to which the linear form fitted the constructed schedules is summarized by the information on distribution of R^2s shown in Table 13.[2] Seven districts for which R^2s were below 0.6 were excluded from the sample. Estimated values of STR, EXP, and DEG for the other 195 districts were then treated as data in all regressions involving those magnitudes as dependent or independent variables.

REGRESSION EQUATIONS FOR SALARY SCHEDULE PARAMETERS

Tables 14 and 15 present regression equations in which the dependent variables are teacher starting salary, salary increment per year of experience, and salary increment for an M.A. degree. The data on these variables were generated by the estimation procedure described above. Inde-

---

[1] We lacked information on the maximum number of experience increments allowed by each district. In preliminary trials we experimented with several alternative rules for the determination of δ. Results were consistently superior when the maximum was set at 15 years.

[2] As an indication of the degree to which the lack of complete information degrades the results, we note that Alexander (p. 13) reports R^2s of .98 or better for 92 percent of his regressions, which were performed on actual salary schedule data.

Table 13

DISTRIBUTION OF R^2 IN ESTIMATING EQUATIONS FOR TEACHERS' SALARY PARAMETERS

Value of R^2	Proportion of Districts	
	1968-1969	1969-1970
$R^2 > .9$	.50	.43
$.9 \geq R^2 > .8$	.32	.35
$.8 \geq R^2 > .6$	.17	.20

pendent variables in this set of regressions are the same as in the equations presented in Chapters II and III.

Starting Salary

A glance at the tables is enough to show that these equations explain very little interdistrict variation in starting salary (STR). It should be recognized, however, that there is very little variance to explain. The mean estimated starting salary in the 202 districts of the original 1969-70 sample is $7278, and the standard deviation is $483—only 6.6 percent of the mean. In this respect, the Michigan and California data are very similar. Alexander found starting salaries for teachers with B.A. degrees and no experience to be "remarkably uniform" throughout California, with a standard deviation equal to only 7 percent of the mean.[1]

The starting salary equations show a low elasticity of the dependent variable with respect to per pupil spending—.14 to .15 in both 1968-69 and 1969-70. This is slightly higher than the .09 to .10 values reported by Alexander. Of the socioeconomic (SES) variables, high-level employment has a significant negative effect on STR and middle-level employment has a positive, but only marginally significant effect. The finding about the effect of the high-level employment variable appears to contradict results of the California study, which reported positive associations of all SES indicators—family income, percent in professional occupations,

---

[1] Alexander, p. 15.

Table 14

REGRESSION EQUATIONS FOR TEACHER STARTING SALARY, DEGREE INCREMENT, AND EXPERIENCE INCREMENT, 1969-70

Equation	Dependent Variable	Constant	Log of Budget per Pupil (BUD2)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Log of Clerical Income (CLRY)	Log of Teacher Pupil Ratio (TNO2)	R^2	F
S1	log of starting salary; STR2	8.2 (53.5)	.11 (4.6)							.10	22
S2		7.9 (42.8)	.15 (4.8)	-.12 (-1.8)	.18 (1.8)	-.05 (-0.8)	-.02 (-1.2)			.15	7
S3		7.7 (24.4)	.15 (4.7)	-.12 (-1.9)	.13 (1.1)	-.06 (-0.9)	-.03 (-1.3)	.02 (0.6)		.15	6
S4		7.5 (21.1)	.[illegible]4 (4.1)					.03 (1.0)	-.08 (-1.7)	.13	9
D1	log of degree increment: DEG2	3.7 (3.6)	.50 (3.3)							.05	11
D2		3.2 (2.6)	.54 (2.7)	.10 (0.2)	.36 (0.5)	-.18 (0.5)	-.05 (-0.4)			.06	2
D3		-0.5 (-0.2)	.50 (2.4)	-.02 (-0.1)	-.64 (-0.7)	-.33 (-0.8)	-.08 (-0.6)	.53 (2.2)		.08	3
D4		-3.0 (-1.3)	.77 (3.5)					.30 (1.4)	-.78 (-2.4)	.10	7
E1	log of experience increment; EXP2	2.9 (6.0)	.44 (5.8)							.15	34
E2		3.4 (6.2)	.23 (2.5)	.58 (3.0)	1.8 (5.9)	.50 (2.8)	.03 (0.6)			.29	15
E3		0.3 (0.4)	.19 (2.2)	.48 (2.5)	.98 (2.8)	.38 (2.2)	.01 (0.2)	.44 (4.1)		.35	17
E4		-2.4 (-2.3)	.42 (4.3)					.56 (5.9)	-.24 (-1.7)	.32	30

NOTE: Numbers in parentheses are t values.

Table 15

REGRESSION EQUATIONS FOR TEACHER STARTING SALARY, DEGREE INCREMENT, AND EXPERIENCE INCREMENT, 1968-69

Equation	Dependent Variable	Constant	Log of Budget per Pupil (BUD1)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Log of Clerical Income (CLRY)	Log of Teacher Pupil Ratio (TNC2)	R^2	F
S1	log of starting salary: STR1	8.1 (46.6)	.11 (4.1)							.08	17
S2		7.9 (38.6)	.14 (4.0)	-.12 (-1.7)	.13 (1.3)	-.02 (-0.2)	-.007 (-0.3)			.11	5
S3		7.8 (23.6)	.14 (3.9)	-.12 (-1.7)	.10 (0.8)	-.02 (-0.4)	-.008 (0.4)	.02 (0.6)		.11	4
S4		6.3 (20.0)	.15 (4.4)					.02 (0.7)	-.12 (-2.5)	.12	8
D1	log of degree increment: DEG1	2.4 (2.4)	.69 (4.4)							.09	19
D2		2.3 (1.9)	.69 (3.4)	.007 (0.0)	.38 (0.6)	-.32 (-0.9)	.09 (0.8)			.10	4
D3		0.7 (0.4)	.66 (3.2)	-.04 (-0.1)	-.04 (-0.1)	-.38 (-1.0)	.08 (0.7)	.24 (1.1)		.11	4
D4		0.8 (0.4)	.63 (3.0)					.25 (1.3)	-.006 (-0.0)	.10	7
E1	log of experience increment: EXP1	1.4 (2.5)	.66 (7.6)							.23	58
E2		1.9 (3.1)	.45 (4.4)	.50 (2.5)	1.9 (6.3)	.47 (2.6)	.01 (0.2)			.37	22
E3		-.24 (-.02)	.41 (4.0)	.44 (2.2)	1.4 (3.8)	.39 (2.2)	-.004 (-0.1)	.31 (2.8)		.39	20
E4		-2.2 (-2.0)	.51 (4.9)					.54 (5.5)	0.0 (0.0)	.34	33

NOTE: Numbers in parentheses are t values.

and percent college educated--with starting salary.[1] The other SES variables, percent minority and the central city dummy variable, have no consistent effects.

An interesting finding is that there is no significant relationship between STR and the clerical wage level (CLRY). Alexander reports a small but consistently positive effect.[2] The lack of such a relationship casts doubt on the validity of interpreting CLRY as a proxy measure of the opportunity wage for teachers. In Chapter II, we reported an apparent contradiction between a positive STR coefficient and a negative CLRY coefficient in the equations for per pupil expenditure for teachers. The finding that STR and CLRY are unrelated suggests that there may not be a contradiction at all, since CLRY may be representing community characteristics other than wage level.

An issue of some theoretical significance, which was discussed in Chapter II, is whether teacher starting salary can legitimately be treated as an exogenous variable in attempts to explain variations in spending and staff-pupil ratios, or whether it is better interpreted as a policy variable set by the school district. No definitive answer can be given here because adequate information is not available to support tests of alternative salary determination hypotheses. To carry out proper tests, we would need measures of alternative wages in each labor market area (not necessarily the immediate school district in which teacher salaries are observed) and information on such related labor market factors as unionization in school systems and other sectors and levels of unemployment. A proper comparative analysis of alternative teacher market models would be a major undertaking. For the immediate purposes of this study, we merely observe that the simple R^2 between STR and budget level is sufficiently low--.08 to .10--to pose little threat to the validity of regressions in which STR is treated as an independent variable on grounds of simultaneous equations bias.

Degree Increment

There is more interdistrict variation in the degree increment parameter (DEG) than in starting salary. The standard deviation of DEG is \$406, which is 36 percent of its mean value, \$1122. As can be seen from Eqs. D1 through D4 in Tables 14 and 15, even less of the variance in DEG is explained than in starting salary. The best R^2 values in both the 1968-69 and 1969-70 regressions are on the order of .10. This poor performance may be accounted for largely by our crude method of constructing district salary schedules. The main shortcoming of the method is that we had to collapse all educational level columns of the schedule into a simple two-way distinction between teachers with and without M.A. degrees. This shortcoming should affect estimates of DEG most severely, since all the lost information pertains to the rewards for post-B.A. training. Despite the poor fit of the estimating equations, two findings emerge. First, the increment paid for an M.A. degree is sensitive to the budget level. Elasticities estimates for 1969-70 and 1968-69 are about .50 and .66, respectively. This suggests that there is a strong tendency for districts to try to attract more highly educated teachers as their budgets increase. Second, the degree increment appears to be positively related to the clerical wage level, CLRY (although the CLRY coefficient is only marginally significant in the 1968-69 regressions). Coupled with the finding that starting salary and CLRY are unrelated, this may signify that labor market competition between the public schools and other economic sectors is more intense over higher-skilled than entry-level workers. None of the SES variables has a significant effect on the degree increment in this set of regressions, which is not surprising given the crudity of the data.

---

[1] Alexander, pp. 15-16.

[2] Ibid., p. 16, Table 5.

Alexander's results in this area are not parallel to ours because he was able to use the number of post-B.A. credit hours of coursework as a measure of the level of teacher training. He reports an elasticity of the increment per credit hour with respect to per pupil spending of about .18. He also supports our finding of a positive relationship between the size of the reward for increased training and the level of clerical wages.[1]

---

[1] Alexander, p. 18, Table 6.

Experience Increment

There is less interdistrict variation in the salary increment per year of experience than in the increment for an M.A. degree. The standard deviation of the experience increment (EXP) is \$68, or 21 percent of the mean value, \$330. Regression equations for EXP have higher R^2s than equations for the degree increment parameter (DEG), but estimates of the elasticity of EXP with respect to per pupil spending are more erratic. Estimates for 1969-70 (Eqs. E2 and E3 in Table 14) are on the order of .20, while those for 1968-69 (the corresponding equations in Table 15) are on the order of .40. As already mentioned, there is a positive relationship between the size of EXP and clerical income (CLRY). The coefficients of CLRY are highly significant in both years and in the same size range--.25 to .50--as the CLRY coefficients in the equations for DEG. This finding supports the speculation that school districts are forced to compete vigorously with alternative employers for services of more experienced or more qualified workers, even though they have less need, as shown by the insensitivity of starting salary to CLRY, to compete for new college graduates. The size of EXP is also significantly positively related to high-level employment (EMPH), middle-level employment (EMPM), and percent minority (BLCK); i.e., other things being equal, EXP tends to be smaller in white communities where much of the employment is in low-level (working class) occupations. The positive association between rewards for experience and socioeconomic status is not surprising, but it is not clear how one should interpret the tendency to pay more for experience in communities having large minority populations.

Our findings about the experience increment agree with Alexander's fairly well with respect to budget elasticity (his estimate is about .38), the proportion of variance explained, the positive association with socioeconomic status (his variable is family income), and the positive association with clerical income. We have much more confidence in our findings about experience increment than degree increment because we had full information to work with on salaries associated with each step on the experience scale (from 0 to 15 years.)

REGRESSION EQUATIONS FOR AVERAGE TEACHER EXPERIENCE AND PERCENT WITH M.A. DEGREE

Regression equations in which average teacher experience (AXP) and percent of teachers with Master's degrees (PCM) are the dependent variables are presented in Tables 16 and 17. The two sets of results are quite different. As can be seen from Eqs. X1 and X2 in both of these tables, there appears to be only a slight tendency for AXP to increase with budget when no other variables are taken into account. But when clerical income and the SES variables are added to the equation, the estimated budget elasticity rises to about .35 in both the 1968-69 and 1969-70 equations. In contrast, PCM increases sharply with the budget, and the elasticity estimates are insensitive to inclusion of other variables. The t-values of the budget coefficients are also very high--at least 8.0 in all cases. Despite these statistics, we are skeptical of the validity of these equations because of the crudity of the PCM variable as compared with a variable that measures educational level in a more continuous manner.

Average teacher experience is negatively related to the high-level and middle-level employment variables, EMPH and EMPM; i.e., teachers tend to be more experienced in working class communities. In the previous section, we reported that the pay increment for each year of experience is positively related to EMPH and EMPM. Thus, higher SES districts pay more for added experience, but attract a smaller proportion of more experienced teachers. The explanation for this seemingly perverse result may be simple. It may be that lower-SES districts have grown more slowly than higher-SES districts, so that there has been less need to hire new, younger teachers to keep up with expanding enrollment. This is plausible because many higher-SES districts are suburbs, which have grown faster than either central city or rural districts. Unfortunately, we did not have the enrollment growth or staff turnover data needed to test this conjecture. Holding EMPH and EMPM constant, there is a positive relationship, although only marginally significant, between AXP and the central city dummy variable. At a given budget level, therefore, central cities tend both to pay more for experience and to employ more experienced employees. No variable other than the budget level is signifi-

Table 16

REGRESSION EQUATIONS FOR AVERAGE TEACHER EXPERIENCE AND PERCENT TEACHERS WITH MASTER'S DEGREE, 1969-70

Equation	Dependent Variable	Constant	Log of Budget per Pupil (BUD2)	Log of Experience Increment (EXP)	Log of Degree Increment (DEG)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Log of Clerical Income (CLRY)	R^2	F
X1	log of average experience: AXP2	.99 (1.6)	.18 (1.9)								.02	3
X2		2.4 (2.1)	.34 (3.1)			-.83 (-3.5)	-2.1 (-4.8)	-.24 (-1.1)	.10 (1.4)	-.18 (-1.3)	.28	12
X3		2.2 (3.5)	.36 (3.7)	-.42 (-4.9)							.13	14
X4		1.9 (2.7)	.38 (3.5)	-.23 (-2.7)		-.74 (-3.1)	-2.0 (-5.1)	-.17 (0.8)	.10 (1.4)		.29	13
M1	log of percent M.A. degree: PCM2	-4.5 (-6.1)	1.2 (10.6)								.37	113
M2		-4.4 (-2.8)	1.2 (8.0)			.33 (1.0)	-.02 (-0.0)	-.07 (-0.2)	-.08 (0.8)	-.03 (-0.2)	.38	19
M3		-5.2 (-7.2)	1.1 (9.8)		.20 (4.0)						.42	69
M4		-5.2 (-5.9)	1.1 (7.5)		.19 (3.8)	.31 (1.0)	-.14 (-0.3)	-.04 (-0.2)	-.07 (-0.8)		.43	23

NOTE: Numbers in parentheses are t values.

Table 17

REGRESSION EQUATIONS FOR AVERAGE TEACHER EXPERIENCE AND PERCENT TEACHERS WITH MASTER'S DEGREE, 1968-69

Equation	Dependent Variable	Constant	Log of Budget per Pupil (BUD1)	Log of Experience Increment (EXP)	Log of Degree increment (DEG)	Percent High-level Empl. (EMTH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	Log of Clerical Income (CITY)	R^2	F
X1	log of average experience: AXP1	1.6 (2.3)	.085 (0.8)								.003	0.6
X2		2.4 (2.1)	.37 (3.0)			-1.1 (-4.4)	-2.1 (-4.8)	-.27 (-1.3)	.11 (1.7)	-.19 (-1.4)	.28	12
X3		2.2 (3.2)	.37 (3.1)	-.43 (-4.9)							.12	13
X4		1.6 (2.1)	.45 (3.6)	-.23 (-2.6)		-.98 (-4.1)	-2.0 (-5.0)	-.21 (-1.0)	.11 (1.6)		.30	13
M1	log of percent with M.A.: PCM1	-7.5 (-9.1)	1.65 (12.9)								.46	166
M2		-6.0 (-3.8)	1.70 (10.2)			.02 (0.1)	.38 (0.6)	.02 (0.1)	-0.0 (0.0)	-.23 (-1.3)	.47	27
M3		-7.7 (-9.2)	1.59 (11.9)		.094 (1.6)						.47	85
M4		-7.8 (-7.8)	1.60 (9.5)		.095 (1.6)	-.03 (-0.1)	-.07 (-0.1)	-.01 (-0.0)	-.02 (-0.2)		.47	28

NOTE: Numbers in parentheses are t values.

cantly associated with PCM. This may reflect nothing more than the crudity of this dependent variable.

The last two regression equations for each dependent variable (e.g., Eqs. X3, X4, M3, and M4 in Tables 16 and 17) were included to investigate the price-like effects of experience increment (EXP) and degree increment (DEG) on average experience (AXP) and percent of teachers with Master's degree (PCM), respectively. If EXP and DEG were exogenous they would be the appropriate price variables to include in the AXP and PCM equations. Since both EXP and DEG depend on the budget level, however, it is likely that the coefficients are biased. Nevertheless, the results do bring out an important difference between the relationship of AXP to EXP, on one hand, and the relationship of PCM to DEG, on the other. Note that in the equations for AXP the coefficients of EXP are negative. Districts that reward experience most generously tend to have less experienced teaching forces. A possible explanation for this outcome has already been suggested. In contrast, the coefficients of DEG in equations for PCM are positive. Districts that pay the most for the advanced degree employ relatively more teachers with M.A.s. The difference in signs of the salary increment coefficients in the two instances may indicate that school districts are better able to control degree level than average experience. Decisions to seek advanced training and to remain with or leave a district are made by individual teachers. When a district is growing, its officials have little choice but to employ new teachers, many of whom will be inexperienced; when a district is stable in size, its teaching force is likely to become older and more experienced, regardless of officials' preference. In hiring new teachers, however, a district is able to exercise a preference for teachers with advanced degrees. It may also have more leverage over teachers' decisions to obtain advanced training than over teachers' decisions about terminating employment. Unfortunately, we were not able to test these conjectures in this study. A detailed analysis of patterns of teacher turnover and training histories would be needed to determine whether degree level is, in fact, "more endogenous" than average experience.

Alexander did not treat either average teacher experience or educational attainment as variables to be explained statistically. Implicitly, he assumed that they are determined by individual teachers and that they are not influenced by district policies. Therefore, no comparison with his results is possible.

SOURCES OF VARIATION IN AVERAGE TEACHER SALARY

Having developed regression equations for all five components of teacher salary, we are now in position to analyze the relative contributions of each factor to interdistrict variations in average teacher pay. In particular, we are interested in differentiating between average salary variations that are due to differences in salary schedule parameters and those that reflect differences in teacher qualifications. In Chapter III, we found that the elasticity of average teacher salary with respect to total spending per pupil is on the order of .30 to .35. We now ask how much of this 3 or 3.5 percent increase associated with each 10 percent increment in budget is attributable to the tendency of high-spending districts to pay their teachers more and how much is attributable to their tendency to employ more highly trained teachers.

To answer these questions we considered a district that initially has 1969-70 sample mean values of all variables, as follows:

Average teacher experience (AXP).............	9.0 years
Fraction of teachers with M.A. (PCM)..........	0.25
Teacher starting salary (STR).................	\$7280
Increment for M.A. degree (DEG)..............	\$1120
Increment for experience (EXP)...............	\$330 per year

The average starting salary in the district (SAL) may be calculated from the relationship,

$$SAL = STR + AXP \cdot EXP + PCM \cdot DEG.$$

Using the foregoing values, the average salary level in the district is

$$SAL = \$7280 + (9.0 \times \$330) + (0.25 \times \$1120) = \$10,530.$$

Let us first examine the effect of a 10 percent increase in per pupil spending, holding average experience and percent of teachers with M.A. degrees constant. The estimated budget elasticities of the three salary schedule parameters, STR, EXP, and DEG, for 1969-70 (from Eqs. S3, E3, and D3 of Table 14) are .15, .19, and .50, respectively. Therefore, the values of the three parameters would increase by 1.4, 1.8, and 4.9 percent, respectively, in response to a 10 percent increase in the budget. The resulting increase in average salary would be

$$(\$7280 \times 0.14) + (9.0 \times \$330 \times .018) + (.25 \times \$1120 \times .049) = \$169,$$

or 1.6 percent of the original level, $10,530.

Let us next examine the effect of the same percentage increase in budget, holding the salary schedule parameters constant. From Table 16, the estimated elasticities of AXP and PCM with respect to budget are .34 and 1.2, which means that the two factors would increase by 3.3 percent and 12.1 percent, respectively, in response to a 10 percent increase in budget. The resulting increase in average salary would be

$$(.033 \times 9.0 \times \$330) + (.121 \times .25 \times \$1120) = \$132,$$

or 1.25 percent of average salary. Finally, letting all five factors vary with per pupil spending, we compute a new average salary of

$$(\$7280 \times 1.014) + (9 \times \$330 \times 1.018 \times 1.033) + (.25 \times \$1120 \times 1.049 \times 1.121)$$
$$= \$10,834,$$

which is $304, or 2.9 percent, greater than the initial level. A 2.9 percent increase in average salary in response to a 10 percent change in budget implies an elasticity of average teacher salary with respect to per pupil spending of .29, which is very close to the value of .28 reported in Table 9. We conclude that about 55 percent (1.6/2.9) of the increase in average teacher salary associated with the higher budget level is attributable to increases in salary schedule parameters. The remaining 45 percent is attributable to movement along the schedule to higher average levels of experience and education.

SUMMARY OF FINDINGS

The main findings of the analysis of the components of average teacher salary are as follows: Estimated elasticities with respect to per pupil spending of the three salary schedule parameters--starting salary, experience increment, and degree increment--are .15, .19, and .50, respectively, according to the 1969-70 regression equations. Estimated elasticities with respect to per pupil spending of the two teacher qualification variables--average experience and percent with M.A. degree--are .34 and 1.2, respectively. These estimates may be combined in several different ways. As we have shown above, in a district that initially has mean values of all independent variables, slightly more than half (55 percent) of a budget-related increment in average teacher salary can be attributed to the combined upward movement of the three salary schedule parameters. The remainder is due to increased experience and a larger fraction of teachers with M.A. degrees. Grouping components differently, 34 percent of the increment in average teacher salary is attributable to an increase in starting salary, 50 percent to an increase in the amounts paid for experience, and 16 percent to an increase in premiums for advanced degrees.

As to socioeconomic characteristics, the starting salary of teachers is lowest in districts of high socioeconomic status (as measured by percent of employed persons in high-level occupations) and highest in districts of middle socioeconomic status; other SES characteristics have no effect. Neither the salary increment paid for an M.A. degree nor the percentage of teachers in a school district who have M.A. degrees is affected by any SES characteristic included in the analysis. The two dependent variables pertaining to teacher experience are affected by SES characteristics in the following reciprocal manner: The salary increment paid by a school district per year of teaching experience is lowest in low-SES districts, higher in high-SES districts, and highest in districts that fall in the middle of the SES scale. It also tends to be high in districts with large minority populations. The average number of years of experience per teacher follows precisely the opposite pattern: It is high in the low-SES districts, lower in the high-SES districts, and lowest in districts of intermediate status. Average experience is also higher in central city districts than elsewhere.

Some of the results presented in this chapter are of questionable validity because of the poor fit of the estimating equations. This is especially true of results pertaining to the degree increment parameter (DEG), which are also questionable because of the crude method used to derive estimates of degree increments paid by individual districts. One aspect of the results that does provide encouragement, however, is their consistency with the regression equations for average teacher salary presented in Chapter III.

The results cannot be used to resolve controversies about causal relationships: E.g., do higher-spending school districts tend to have more experienced staffs because their officials value experience or because qualities of such districts induce teachers to remain employed longer? Nor can the results be used to do rigorous testing of alternative hypotheses about the process of teacher salary determination. However, we do find that teacher starting salary is sufficiently independent of the level of per pupil spending in a district that it may legitimately be used as an independent variable in regression equations for other resource variables.

V. THE DISCRETIONARY BUDGET MODEL

Although the cross-sectional results reported in Chapters II, III, and IV are satisfying in many respects, they are subject to the standard criticism leveled at any attempt to develop cross-sectional relationships for predictive purposes: There is no guarantee that relationships discovered by comparing different districts at a single point in time will adequately represent the behavior of individual districts over time. A district that had a low budget in the years studied would not necessarily begin to spend its money like one of the high-budget districts in the sample if additional funds became available. It is possible that some of the same factors that caused the district to have a low budget initially would also influence its allocative behavior and would continue to have that influence even after the budget level was raised by an external action.[1] Normally, little can be done to explore the consistency of cross-sectional results with behavior over time. In this case, however, the opportunity exists to examine changes in district expenditure patterns from the 1968-69 to the 1969-70 school year. While a two-year data base obviously can not support a true time series analysis, it does permit us to determine whether year-to-year changes in district outlays are consistent with the marginal behavior implied by the cross-sectional results.

There is another, perhaps more compelling, reason to take advantage of the opportunity to investigate year to year changes in the budgets of the Michigan school districts. As was mentioned in Chapter I, school districts are not as unconstrained in allocating their resources in any given year as the cross-sectional model implies. It appears to be nearly automatic behavior, except in cases of dire fiscal emergency, for a school district to rehire all teachers employed in the previous year who do not voluntarily terminate and to pay them at least the salaries called for by their new positions on the salary scale, including the increment for an additional year's seniority. To a large extent, this behavior is not merely customary, but is required by tenure provisions and collective bargaining agreements. Thus, the district has very little control over either the number of retainees or their average salaries, and precommitted outlays for the salaries of retained teachers may amount to a large fraction of the total district budget. Much the same may be true for administrators and specialists and for many of the nonpedagogical personnel employed by school systems, whose salaries make up a large part of the "other expenditure" category of the district budget. The portion of the budget that is not subject to these prior claims, which may be only a small fraction of the total, is what we refer to as the "discretionary budget." It is impossible to determine the size of the discretionary component from cross-sectional data for a single year. Information is required about the number of staff members retained from the prior year and about the salary schedules that were then in effect. With this information, however, it becomes possible to measure the discretionary budget and to focus the analysis on the small but critical portion of the budget that district officials really control. In this chapter, we develop operational definitions of the discretionary budget and formulate an empirically testable model of school district behavior in allocating uncommitted funds.

---

[1] It is well established in the literature that the strongest determinant of the level of per pupil spending in a district is the district's wealth--in particular, the property tax base per pupil; see, e.g., S. M. Barro, "An Econometric Study of Public School Expenditure Variations Across States, 1951-1967," The Rand Corporation, P-4934, 1972; D. Stern, "The Effects of Alternative State Aid Formulas on the Distribution of Public School Expenditures in Massachusetts," *Review of Economics and Statistics*, Vol. 60, February 1973; and Alexander, pp. 4-6. Nevertheless, variables other than wealth, including socioeconomic and demographic characteristics and other "taste" variables have a role and could affect budget allocations as well.

RESOURCE CONSTRAINTS AND THE DISCRETIONARY BUDGET

The key assumption of the discretionary budget model is that each Michigan district was committed in 1969-70 to pay all retained teachers the amount called for by the 1968-69 salary schedule before considering such options as improving the schedule, hiring additional staff, or spending more per pupil on other resources. Additional assumptions, which we sometimes do and sometimes do not include in the model, are that (a) each district had similar obligations with respect to retained administrators and specialists and (b) each district was committed to providing at least prior-year levels of other resources. The amount of money that can be considered available for allocation at a district's discretion depends on which of these assumptions about budget constraints are in effect. We consider four definitions of the discretionary budget per pupil, corresponding to four sets of assumptions about the nature of a district's inherited obligations.

The budget constraint facing a school district in 1969-70 may be written in abbreviated form as

$$BUD2 = TNO2 \cdot SAL2 + XOTH2,$$

where BUD2 is total current expenditure per pupil, TNO2 is the teacher-pupil ratio, SAL2 is average teacher salary, and XOTH2 is per pupil expenditure for all resources other than teachers (note that "other resources" now comprises administrators and specialists in addition to the "other" category defined in the cross-sectional analysis). The suffix "1" identifies 1968-69 values and the suffix "2" identifies 1969-70 values of variables. Suffixes are omitted where there is no ambiguity. The teaching force in 1969-70 (year 2) can be divided into two groups --teachers retained from 1968-69 (year 1) and teachers newly hired in year 2. Similarly, the teacher-pupil ratio in year 2 can be divided into two components--the ratio of retained teachers to pupils (RTNO) and the ratio of newly hired teachers to pupils (HTNO). By definition, TNO2 = RTNO + HTNO. Denote the average salary of retained teachers by SALR2 and the average salary of newly hired teachers by SALH. The budget constraint can then be rewritten as

$$BUD2 = RTNO \cdot SALR2 + HTNO \cdot SALH + XOTH.$$

Next, we decompose the average salary of retained teachers, (SALR2) into two parts, the average salary that would have been paid to those teachers under the 1968-69 salary schedule and the increment in average salary due to improvement of the salary schedule between 1968-69 and 1969-70. We label the first component SALR1 and the second ΔSALR. Assume, for simplicity, that the improvement in salary schedules took the form of a uniform percentage increase in all three salary schedule parameters--starting salary, degree increment, and experience increment. Let α represent the fraction by which the salary schedule improved; i.e., $\alpha = \Delta SALR/SALR1$. Then $SALR2 = (1 + \alpha)SALR1$ or, equivalently, $SALR1 = SALR2/(1 + \alpha)$. The salary increment is related to salary in year 2 according to the equation $\Delta SALR = SALR2 \cdot \alpha/(1 + \alpha)$. With SALR2 broken down into its components, the budget constraint becomes

$$BUD2 = RTNO \cdot SAL1 + RTNO \cdot \Delta SALR + HTNO \cdot SALH + XOTH$$

$$= RTNO \frac{SALR2}{1 + \alpha} + RTNO \frac{\alpha SALR2}{1 + \alpha} + HTNO \cdot SALH + XOTH.$$

The first term on the right-hand side of this equation is the per pupil expenditure that would have been made for retained teachers according to the 1968-69 salary schedule, the second term is the additional outlay per pupil for retained teachers attributable to salary schedule improvement, and the third and fourth terms are the outlays per pupil for newly hired teachers and for other inputs. We are now prepared to define the various versions of the district discretionary budget.

Assuming that the only constraint facing the district is that it must pay all retained teachers according to the prior year salary scale, the amount of money per pupil earmarked in advance for retained teachers is $RTNO \cdot SALR2/(1 + \alpha)$. The remainder of the budget is unconstrained. The unconstrained amount, which we denote by DBD1, is

$$DBD1 = BUD2 - RTNO \frac{SALR2}{1 + \alpha},$$

This is version 1 of the discretionary budget per pupil. DBD1 can also be written as

$$DBD1 = BUD2 - \frac{XPRT2}{1 + \alpha},$$

where XPRT2 is expenditure per pupil in 1969-70 for teachers retained from 1968-69.

A slightly different definition of the discretionary budget follows from the assumption that districts are obligated to pay retained administrators and specialists, as well as teachers, according to the 1968-69 salary schedule before contemplating other uses of funds. Expenditures for all three categories of personnel are treated in the same manner.[1] The resulting measure of discretionary budget, DBD2, is

$$\mathrm{DBD2} = \mathrm{BUD2} - \frac{1}{1+\alpha}(\mathrm{XPRT2} + \mathrm{XPRA2} + \mathrm{XPRS2}),$$

where XPRA2 and XPRS2 are expenditures per pupil in 1969-70 for administrators and specialists retained from 1968-69.

A third possible definition of the discretionary budget is the same as the second definition except that the additional assumption is made that the district must spend at least as much in total--not per pupil--in 1969-70 for "other" resources (exclusive of teachers, administrators, and specialists) as it did in 1968-69. The rationale is parallel to that for the treatment of professional personnel: It is assumed that the district will not eliminate resources already acquired except in severe financial emergencies. Let XPO1 denote expenditure per pupil in year 1 (1968-69) for "other" resources. Total outlay for that category in year 1 is then XPO1·PUP1, where PUP1 is the number of pupils in the district in year 1. The amount per pupil in year 2, keeping total other expenditure fixed, is then XPO1·PUP1/PUP2. The definition of the third discretionary budget concept, DBD3, may be written as

$$\mathrm{DBD3} = \mathrm{BUD2} - \frac{1}{1+\alpha}(\mathrm{XPRT2} + \mathrm{XPRA2} + \mathrm{XPRS2}) - \mathrm{XPO1}\,\frac{\mathrm{PUP1}}{\mathrm{PUP2}}.$$

The fourth and final definition of the discretionary budget derives from the assumption that the district must pay all retained teachers according to the 1968-69 salary schedule and, in addition, must expend at least as much per pupil for administrators, specialists, and other resources as it did in the base year. Let XPA1 and XPS1 represent per pupil expenditures for administrators and specialists in year 1. Then DBD4 is given as

---

[1] It is assumed that the salary schedules for admininstrators and specialists are increased by the same rate as the schedule for teachers.

$$\mathrm{DBD4} = \mathrm{BUD2} - \frac{1}{1+\alpha}\,\mathrm{XPRT2} - (\mathrm{XPA1} + \mathrm{XPS1} + \mathrm{XPO1}).$$

In Chapter VI, each of the four measures of the discretionary budget definitions appears in regression equations seeking to explain uses of discretionary funds.

ESTIMATING THE INTERYEAR INCREASE IN TEACHER SALARY SCHEDULES

In order to compute discretionary budget amounts, as defined above, we need estimates of α, the rate of increase in the teacher salary schedule, for every school district. We considered several methods of approximating α by using the previously derived estimates of the three salary schedule parameters--STR, DEG, and EXP--for 1968-69 and 1969-70. We rejected each of these methods as unsatisfactory and decided instead to use a statistical estimation method based on the individual cell values of the teacher salary schedules we constructed for each district.[1]

Our initial estimation was based on the hypothesis that the entire salary schedule in each district would tend to shift upward by a fixed absolute amount between the two school years. Accordingly, we ran the following regression equation for each of the 195 Michigan districts in our sample:

$$S_{YD}(69\text{-}70) = \beta_0 + \beta_1 S_{YD}(68\text{-}69),$$

where S_{YD} is the average salary the district paid teachers with Y years of experience and degree level D in the indicated year (D = 0 for the B.A. degree cells of the salary schedule; D = 1 for the M.A. degree cells). Each such regression was fitted to 32 points--the salary combinations corresponding to each of the two degree possibilities and to experience ranging from 0 to 15 years. The values of β_0 obtained from these regressions were consistently small and never significant and the values of β_1 were consistently larger than one. R^2 ranged between 0.6 and 0.9. These results suggested that the hypothesis of a fixed absolute increase in each cell of the salary schedule was incorrect and that the hypothesis of a proportional increase, i.e., a fixed percentage increase in each cell value, would be more appropriate. Accordingly, we reran the regressions for each district with the constant suppressed, i.e., in the form

---

[1] One possible method was to use the rate of increase in teacher starting salary (STR) as an index of the rate of increase in the whole salary schedule. We were discouraged from using this method by the finding from the cross-sectional analysis that the other salary schedule parameters (DEG and EXP) tended to increase more rapidly than STR in relation to the level of per pupil spending. Since per pupil spending is higher in 1969-70 than in 1968-69, the use of STR as an index would tend to understate the rate of increase in the salary schedule in most districts. A second possibility was to disaggregate the analysis by examining rates of increase in each of the three salary schedule parameters

$$S_{YD}(69\text{-}70) = \beta S_{YD}(68\text{-}69).$$

These results were more satisfactory. The values of β for these regressions were below 1.0 in 6 districts; they fell between 1.0 and 1.049 in 17 districts, between 1.05 and 1.099 in [illegible] districts, and between 1.1 and 1.149 in 67 districts. The estimated values of β exceeded 1.15 in 20 cases. The value of α, the rate of increase in the salary schedule is equal to β-1. These estimates of α were used in computing DBD1 through DBD4 for each district.

DEPENDENT VARIABLES

Given the values of all variables in the base year, and the amounts of precommitted outlays in the following year, a school district has the following choices about the use of its discretionary funds:

---

separately. This would be the best method in principle; but to carry out the analysis, it would be necessary to work with all five variables that enter into the determination of average teacher salary—the three schedule parameters and the measures of average teacher experience and degree level. This was a more disaggregated level of analysis than we were interested in pursuing. We also had little confidence in the outcome of such an analysis, given the relatively poor results of cross-sectional regressions for some of the five variables and the weakness of the method used to estimate the degree increment parameter.

(1) It can hire new teachers to compensate for terminations or increased enrollments or to improve the overall teacher-pupil ratio.
(2) It can raise the level of the salary schedule.
(3) It can choose to hire new teachers who qualify for more than the starting salary specified by the new schedule (i.e., it can select new teachers with more than a B.A. degree and with some teaching experience).
(4) It can increase its per pupil spending for resources other than teachers above base-year levels.

The dependent variables in the analysis of allocation of the discretionary budget were selected to reflect these four options. Definitions of these variables are as follows:

HTNO is the number of newly hired teachers per pupil in 1969-70.

ALPH, or α, is the percentage increase in the salary schedule between 1968-69 and 1969-70. The method of measuring ALPH was described in the preceding section of this chapter.

DSLH is the fraction by which the salary paid newly hired teachers in 1969-70 exceeds the starting salary in that year, i.e., DSLH = (SALH/STR2) - 1.

DOTH is the change in expenditure per pupil for resources other than teachers between 1968-69 and 1969-70, i.e., DOTH = XOTH2 - XOTH1.

In the presentation of empirical results in Chapter VI, these are the variables that appear on the left-hand side of the regression equations.

HYPOTHESES

A set of hypotheses about school district behavior in allocating discretionary budgets can be derived from a modified version of the constrained maximization model that underlies the cross-sectional analyses in Chapters II through IV. The description of the basic cross-sectional model has been relegated to the Appendix because the model is identical in most respects to a standard utility maximizing model of consumer demand. The modifications associated with the discretionary budget approach are less conventional, however, and they are described in full below.

Consider the budget constraint equation that corresponds to the most restrictive definition of the discretionary budget, DBD4. By definition, the available discretionary funds per pupil can be broken down into three amounts:

(1) The amount required to improve salaries of retained teachers by a fraction ALPH. This amount is the product of the number of retained teachers, their base-year salary, and the rate of salary schedule improvement, or $RTNO \cdot SALR1 \cdot ALPH$.

(2) The amount required to pay newly hired teachers. If all such teachers were paid only the starting salary, this amount would be approximately $HTNO \cdot STR1 \cdot (1 + ALPH)$, i.e., the product of the number of newly hired teachers and the base-year starting salary, modified by the rate of salary schedule improvement.[1] Since some new teachers may be paid more than the starting salary, however, it becomes $HTNO \cdot STR1 \cdot (1 + ALPH) \cdot (1 + DSLH)$.

(3) The amount required to increase per pupil spending for resources other than teachers, DOTH.

The total budget constraint, therefore, is

$$DBD4 = RTNO \cdot SALR1 \cdot ALPH + HTNO \cdot STR1 \cdot (1 + ALPH) \cdot (1 + DSLH) + DOTH.$$

Assume a district preference function of the form

$$U(TNO2,\ STR2,\ DSL2,\ XOTH2;\ TNO1,\ STR1,\ DSL1,\ XOTH1;\ Z)$$

where TNO2 is the teacher-pupil ratio, STR2 is starting salary,[2] DSL2 is the ratio of the average salary of all teachers to the starting salary--a composite measure of teacher experience and education defined analogously to DSLH, XOTH2 is spending per pupil for all resources other than teachers, and Z represents all socioeconomic characteristics. Inclusion of the year 1 variables is consistent with the "habit formation" hypothesis of demand theory, in which the quantity of a good demanded in the prior year serves as an indicator of "taste" for the good in question.[1] The prior-year value of the teacher-pupil ratio, TNO1, may be interpreted as a "target" teacher-pupil ratio for the district--a level that the district seeks to restore in year 2 after it has been reduced to RTNO by teacher terminations and increases in the number of pupils. Only the first four arguments of the preference function include components that can be manipulated by the district in year 2. These arguments can be restated in terms of the dependent variables and predetermined variables as

---

[1] This is an approximation because starting salary in 1969-70 (STR2) is not necessarily equal to $(1 + ALPH) \cdot STR1$. ALPH measures the fractional increase of the salary schedule as a whole, not just the starting salary level.

[2] Strictly speaking, a more general index of the level of the salary schedule should be used instead of starting salary.

$$\mathrm{TNO2} = \mathrm{RTNO} + \mathrm{HTNO},$$

$$\mathrm{STR2} = \mathrm{ALPH} \cdot \mathrm{STR1}$$

$$\mathrm{DSL2} = \frac{\mathrm{RTNO}(1 + \mathrm{DSLR}) + \mathrm{HTNO}(1 + \mathrm{DSLH})}{\mathrm{RTNO} + \mathrm{HTNO}}$$

$$\mathrm{XOTH2} = \mathrm{XOTH1} + \mathrm{DOTH}.$$

DSLR is a ratio analogous to DSLH and DSL, but for year 1 teachers retained in year 2. The preference function may then be rewritten as

$$U'(\mathrm{HTNO}, \mathrm{ALPH}, \mathrm{DSLH}, \mathrm{DOTH}; \mathrm{RTNO}, \mathrm{TNO1}, \mathrm{STR1}, \mathrm{DSLR}, \mathrm{DSL1}, \mathrm{XOTH1}; Z);$$

i.e., as a function of the four dependent variables and an array of predetermined variables. Maximization of this preference function subject to the budget constraint will yield an equation for newly hired teachers per pupil (HTNO) that has the general form

---

[1] Pollack, R. A., "Habit Formation and Dynamic Demand Functions," *Journal of Political Economy*, Vol. 78, No. 1, Part 1, 1970, pp. 745-763.

$$HTNO = f(DBD, RTNO, TNO1, STR1, DSLR, DSL1, XOTH1; Z).$$

There would be similar equations for the three other dependent variables.

By introducing assumptions about the signs of first and second derivatives of the various arguments of the preference function, U', it is possible to derive hypotheses regarding signs of some of the regression coefficients. The formal manipulations are not presented here; however, a summary of the resulting hypotheses is as follows:

(1) All four dependent variables--HTNO, ALPH, DSLH, and DOTH--are expected to be positively related to the size of the discretionary budget per pupil (DBD). That is, when a school district obtains more discretionary money, it is likely to use some of the additional funds to hire new teachers, some to improve the salary schedule, some to pay for teachers with more than minimal experience and training, and some to purchase other resources.

(2) The number of newly hired teachers per pupil (HTNO) is expected to be positively related to the teacher-pupil ratio in the base year (TNO1), and negatively related to the number of retained teachers per pupil (RTNO). The positive effect of TNO1 reflects the "habit formation" hypothesis mentioned above. The negative effect of RTNO is expected because a district that begins the school year with more retained teachers per pupil needs to hire fewer new teachers to attain its target teacher-pupil ratio.

(3) The number of newly hired teachers per pupil should be negatively related to starting salary (STR2). This is an extension of the standard hypothesis from the constrained maximization model that the quantity demanded of a resource declines with its price.

(4) The rate of increase in the level of the salary schedule (ALPH) should be negatively related to both the teacher-pupil ratio in the base year (TNO1) and the number of retained teachers per pupil (RTNO). The rationale for the former is that, other things being equal, a high initial teacher-pupil ratio reflects a preference for large numbers of teachers

relative to highly paid teachers. The rationale for the latter is that a given salary schedule increment is more costly to the district, and therefore less desirable, the higher the ratio of retained teachers to pupils.

(5) ALPH should also be negatively related to the starting salary in the base year (STR1). This reflects the assumption that the advantage to the district of raising its salary by a given fraction becomes smaller when the schedule is already high,

(6) The experience and degree levels of newly hired teachers, and hence the value of DSLH, should increase with DSL1 and decline with DSLR. The reason for the former is that DSL1 represents the school district's taste for teachers with more than minimal experience and training. The reason for the latter is that the higher the level of DSLR, the less is the need to hire new teachers with more than minimal qualifications to attain a teaching staff with the desired experience-education mix.

(7) The increment in per pupil spending for resources other than teachers (DOTH) is expected to increase with RTNO, decrease with TN01, and decrease with the prior-year level of other spending (XOTH1). The basis for the hypothesis about RTNO is that a higher ratio of retained teachers to pupils means that there is less need to hire new teachers and therefore there is more money available to purchase other resources. If the level of TN01 is high, however, the district has a strong tendency to hire new teachers and, therefore, is less inclined to spend money for other resources. The hypothesized negative effect of XOTH1 reflects the assumption that increments in other resources become less urgent when the amount of other resources per pupil is already high.

The foregoing list does not cover the effects of all independent variables on all dependent variables. The directions of some of the effects are ambiguous because of opposed, offsetting effects. In those cases, the hypothesis is merely that an effect exists, but the direction is left unspecified.

One characteristic of the above list of hypotheses is that the base-year teacher-pupil ratio (TN01) and the ratio of retained teachers to pupils (RTNO) are expected to have opposite effects on two dependent variables, HTNO and DOTH. This suggested to us that it might be valuable to examine the effects on those dependent variables of the *difference* between the two ratios. That difference, which we denote by DTNO (DTNO = RTNO - TNO1), has a straightforward interpretation. It is the amount by which the teacher-pupil ratio would change from year 1 to year 2, assuming that no new teachers are hired, for reasons not subject to district control; namely, teacher terminations and changes in enrollment. We will refer to it as the autonomous change in teacher-pupil ratio. Our hypotheses about DTNO, which should be thought of as substitutes for the propositions about RTNO and TNO1 given under items (2) and (7), above, are that HTNO should be negatively related and DOTH should be positively related to DTNO. That is, an autonomous increase in teacher-pupil ratio (caused, say, by declining enrollment) should lead to few, if any, new hirings and to increased outlays for other resources, while an autonomous decrease in teacher-pupil ratio (caused, say, by a high rate of teacher termination) should lead to hiring of many new teachers to replace toe terminees and to lower increments in other expenditures.

These hypotheses have been developed with reference to the most restrictive definition of the discretionary budget, DBD4. Nevertheless, they remain valid, with one exception, when DBD4 is replaced by any of the other definitions of the amount of discretionary money per pupil. The exception is that the hypotheses pertaining to DOTH must be modified to reflect the different assumptions about spending for other resources used in defining DBD1 through DBD3. All the propositions about the number of teachers and about teachers' salaries have the same form no matter which DBD definition is used. The choice among alternative definitions can be made only on empirical grounds. In performing empirical work based on the discretionary model, we developed four versions of each regression equation--one corresponding to each DBD definition--to ensure that there would be adequate information for comparing the four discretionary budget concepts.

VI. EMPIRICAL ANALYSIS OF DISCRETIONARY BUDGET ALLOCATION

This chapter presents regression equations based on the discretionary budget model developed in Chapter V. The dependent and independent variables were defined in the discussion of the model, but for convenience all definitions are brought together in Table 18. The regression equations shown in the tables of this chapter have been selected from a much larger number generated during the analysis. In addition to experimenting with alternative sets of price variables and socioeconomic characteristics, as in the cross-sectional analysis, we also examined sets of equations containing each of the four versions of the discretionary budget. In discussing the results, we explain how certain equations were selected for inclusion in the tables and refer briefly to the performance of excluded equations.

REGRESSION EQUATIONS FOR NEWLY HIRED TEACHERS

Table 19 presents a set of 16 regression equations in which the dependent variable is HTNO, the ratio of newly hired teachers to pupils in 1969-70. Each of the first eight equations in the table contains as independent variables only (a) a version of the discretionary budget variable (DBD) and (b) either the autonomous change in teacher-pupil ratio (DTNO) or the pair of variables, base-year teacher-pupil ratio (TNO1) and ratio of retained teachers to pupils (RTNO). Our purposes in presenting these equations are, first, to determine how well each of the four definitions of the discretionary budget performs in a regression model, and, second, to test the hypothesis that the single variable DTNO is an adequate substitute for the pair of variables TNO1 and RTNO, as suggested at the end of Chapter V. After examining these eight equations, we selected certain combinations of their independent variables for inclusion in more completely specified regression equations. These equations, which contain prices and socioeconomic characteristics in addition to the discretionary budget and teacher-pupil variables, are exemplified by Eqs. 9 through 16 in Table 19.

Inspection of the coefficients and t-scores of TNO1, RTNO, and DTNO

Table 18

VARIABLES IN THE ANALYSIS OF ALLOCATION OF THE DISCRETIONARY BUDGET[a]

Variable	Definition and Source
DBD1 DBD2 DBD3 DBD4	Alternative measures of the discretionary budget per pupil in 1969-70. See Chapter V for definitions.
ALPH (α)	Fraction by which the level of the teacher salary schedule increased between 1968-69 and 1969-70. See Chapter V for method of estimation.
HTNO	Number of newly hired teachers per pupil in 1969-70.
TNO1	Ratio of teachers to pupils in 1968-69 (same definition as in the cross-sectional analysis)
RTNO	Ratio of the number of teachers who were employed in 1968-69 and retained in 1969-70 to the number of pupils in 1969-70. (Data on number of retained teachers from the PPR files for 1968-69 and 1969-70).
DTNO	Difference between the teacher-pupil ratio in 1968-69 and the ratio of retained teachers to pupils in 1969-70 (DTNO = RTNO - TNO1).
SALR	Average salary of those teachers employed in 1969-70 who were retained from 1968-69 (from PPR file).
SALH	Average salary of newly hired teachers in 1969-70 (from PPR files).
DSLH	Fraction by which the average salary paid to newly hired teachers in 1969-70 exceeds the 1969-70 starting salary (DSLH = SALH/STR2 - 1).
DSLR	Fraction by which the average salary of retained teachers in 1969-70 exceeds the 1969-70 starting salary (DSLH = SALR/STR2 - 1).
DSL1	Fraction by which the average salary of all teachers employed in 1968-69 exceeds the 1968-69 starting salary (DSL1 = SAL1/STR1 - 1).
XOTH1	Per pupil expenditure for all resources other than teachers in 1968-69 (XOTH1 = BUD1 - XPT1).
DOTH	Increase in per pupil expenditure for all resources other than teachers between 1968-69 and 1969-70 (DOTH = (BUD2 - XPT2) - (BUD1 - XPT1)).
STR2	Teacher starting salary in 1969-70 (same definition as in the cross-sectional analysis).

NOTE: The socioeconomic variables CLRY, EMPH, EMPM, BLCK, and CITY have the same definitions as in the cross-sectional analysis. (See Table 1, p. 12)

Table 19

REGRESSION EQUATIONS FOR RATIO OF NEWLY HIRED TEACHERS TO PUPILS IN 1969-70

Equation	Constant	Discretionary Budget (DBD)		Teacher Pupil Ratio Base Year (TNO1)	Retained Teacher to Pupil Ratio (RTNO)	Change in Teacher Pupil Ratio (DTNO)	Log of Teacher Starting Salary (STR)	Log of Clerical Income (CLRY)	% High-Level Employment (EMPH)	% Mid-Level Employment (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	R^2	F
		Version	Coeff.											
1	-.0011 (-0.8)	1	.016 (6.6)			**.49** (11.3)							.41	60
2	.011 (5.5)	1	.023 (9.7)	.24 (4.6)	-.65 (-14.5)								.54	74
3	-.0013 (-1.1)	2	.019 (7.1)			.47 (11.4)							.43	74
4	.011 (5.3)	2	.027 (10.1)	.22 (4.2)	-.61 (-14.5)								.55	76
5	.0017 (2.1)	3	.030 (7.7)			.27 (6.4)							.45	80
6	.014 (7.1)	3	.039 (10.4)	.03 (-0.5)	-.33 (-8.3)								.56	80
7	.0004 (0.6)	4	.027 (11.2)			.48 (13.3)							.57	125
8	.013 (7.5)	4	.033 (14.5)	.24 (5.3)	-.59 (-17.0)								.67	129
9	.017 (4.1)	2	.028 (10.2)	.22 (4.1)	-.61 (-14.6)		-.0008 (-1.6)						.56	59
10	.019 (6.3)	4	.034 (14.8)	.23 (5.2)	-.58 (-17.1)		-.0008 (-1.9)						.68	99
11	.015 (5.2)	2	.031 (11.0)	.18 (3.2)	-.57 (-13.6)				-.002 (-0.5)	-.011 (-2.2)	-.006 (-2.1)	-.003 (-2.6)	.59	38
12	.021 (4.9)	2	.033 (11.1)	.18 (3.2)	-.57 (-13.7)		-.0009 (-1.8)		-.002 (-0.6)	-.009 (-1.8)	-.006 (-2.2)	-.003 (-2.8)	.59	34
13	.021 (5.2)	2	.034 (11.8)	.17 (3.1)	-.58 (-14.3)		-.0008 (-1.7)	-.0016 (-3.4)	0.0 (0.0)	.002 (0.3)	-.004 (-1.6)	-.002 (-2.5)	.62	33
14	.016 (6.3)	4	.034 (14.8)	.19 (3.8)	-.56 (-15.6)				.003 (1.2)	-.005 (-1.3)	-.002 (-0.7)	-.002 (-2.0)	.69	58
15	.021 (5.6)	4	.035 (14.8)	.18 (3.8)	-.56 (-15.7)		-.0008 (-1.8)		.003 (1.2)	-.004 (-0.9)	-.001 (-0.6)	-.002 (-2.0)	.69	52
16	.021 (5.8)	4	.035 (15.0)	.18 (3.8)	-.56 (-15.9)		-.0007 (-1.6)	-.0010 (-2.2)	.005 (1.7)	.003 (0.5)	-0.0 (-0.0)	-.001 (-1.8)	.70	43

NOTE: Sample size is 194. Numbers in parentheses are t values. DBD, STR. and CLRY are measured in $1000s; TNO1, RTNO, and DTNO are numbers of teachers per pupil. Equations are in linear form. The dependent variable is the number of newly hired teachers per pupil (HTNO).

in Eqs. 1 through 8 reveals that the combination of TNO1 and RTNO performs substantially better than the difference between them. If the difference (DTNO) were the appropriate variable, we would expect the coefficients of TNO1 and RTNO to be equal in absolute magnitude and opposite in sign. This clearly is not so. Also, the combination of the two variables explains considerably more variance than DTNO alone. Except in one of the equations containing DBD3 (Eq. 6), the coefficients of both TNO1 and RTNO are highly significant. The hypotheses that HTNO is positively related to DBD and TNO1 and negatively related to RTNO are strongly confirmed by all equations other than Eq. 6. Values of the DBD coefficients range from .023 to .039 in the equations containing DBD, TNO1, and RTNO, depending on which definition of DBD is used. Since DBD is measured in thousands of dollars, this means that for each $100 increase in discretionary funds per pupil, the number of newly hired teachers per pupil increases by about .003. This would be sufficient to reduce the average pupil-teacher ratio in a school district from an initial level of, say, 25 to 23.3.

As for the total variance explained, the four discretionary budget measures rank in the same order as their identifying numbers, although there is only a small difference between DBD1 and DBD2. Estimates of coefficients in the equations containing DBD in combination with TNO1 and RTNO vary only slightly as the discretionary budget measure is changed, except in the case of Eq. 6 where, as noted, the TNO1 coefficient is near zero and not significant. On the basis of these results, we chose combinations of TNO1 and RTNO with discretionary budget measures DBD2 and DBD4 for use in testing the more completely specified models.

In Eqs. 9 and 10, starting salary (STR) is added. It is significantly negative in both equations. This accords with theory and is consistent with the cross-sectional teacher-pupil ratio equations presented in Chapter III. The coefficients of the other variables barely change when STR2 is entered, and the equation R^2 improves slightly. In Eqs. 11 through 16, the effects of including the set of four SES variables used in the cross-sectional analysis are examined with and without STR2 in the equation. Also, the effect of including the clerical income variable (CLRY) is investigated. Of the SES variables, only the dummy variable designating central city districts (CITY) has a consistently significant effect. The effect is negative: fewer new teachers per pupil are hired out of a given discretionary budget. This is consistent with the negative effect of the CITY variable in the cross-sectional regression equations for teacher-pupil ratio. Estimates of the effects of other SES variables are inconsistent. When DBD2 is used as the discretionary budget variable, HTNO appears to be negatively related to percent minority (BLCK) and also to middle-level employment (EMPM). The same coefficients are insignificant in the equations containing DBD4. On the other hand, the high-level employment variable (EMPH) appears significant in the DBD4 equations but insignificant in those containing DBD2. Since coefficients of all these variables are only marginally significant, no definite conclusion can be reached about their effects. Clerical income has a negative effect on HTNO in both the DBD2 and DBD4 equations. The coefficients of starting salary (STR2) change only slightly when CLRY is entered, showing that the latter is not a substitute, or proxy, for the former. This result, too, is in accord with the cross-sectional results.

Equations in which DBD4 is used as the measure of discretionary budget per pupil consistently have higher R^2s than equations that use other discretionary budget definitions. DBD4 is the most restrictive definition of the discretionary budget. It reflects the assumption that districts precommit funds to maintain prior-year levels of administrative and specialist staffing and nonpersonnel resources as well as to support all retained teachers. The superior performance of equations based on this concept tends to support the theory that districts budget incrementally, treating past resource levels as fixed and concerning themselves mainly with allocations of funds not needed to support past commitments.

What sort of adjustment behavior do these relationships represent? To demonstrate the implications of the model, we considered a district with mean values of all relevant variables. For simplicity, we used Eq. 10, which contains the DBD, RTNO, TNO1, and STR variables but not the socioeconomic indicators. Means of the independent variables in the equation are:

DBD4 .... 0.189 ($1000's)
TNO1 .... .042 teachers per pupil
RTNO .... .032 teachers per pupil
STR2 .... 7.264 ($1000's).

The predicted value of HTNO is

$$\begin{aligned} \text{HTNO} &= .019 + .034\text{DBD4} + .23\text{TNO1} - .58\text{RTNO} - .0008\text{STR} \\ &= .019 + (.034 \times .189) + (.23 \times .042) - (.58 \times .032) \\ &\quad - (.0008 \times 7.264) = .011. \end{aligned}$$

Had there been no new teachers hired, the teacher-pupil ratio would have declined by .010--i.e., from .042 to .032 teachers per pupil. The value of .011 for HTNO means that new hiring will just slightly more than offset the loss. The teacher-pupil ratio will be .043, as compared with .042 in the base year.

Suppose now that there is an exogenously caused increase in the budget, say, in the form of an outside grant equal to $70 per pupil, or 10 percent of the sample mean level of per pupil spending. According to the foregoing equation, the increment in HTNO would be .034 x .070, or .0024 teachers per pupil--an increase of .0024/.043, or 5.6 percent in the teacher-pupil ratio. This translates into an elasticity of teacher-pupil ratio with respect to per pupil budget of .56, which agrees well with the estimate of .50 obtained from the 1969-70 cross-sectional regressions (Table 7, Eq. 2).

To illustrate the roles of the RTNO and TNO1 variables, suppose that instead of falling to .032, the number of retained teachers per pupil remains equal to the base-year teacher-pupil ratio, .042. According to Eq. 10, this change of .01 in RTNO would produce a change of .0058 in HTNO. Instead of hiring .011 new teachers per pupil, as estimated above, the district would hire only .0052--less than half as many. Given the higher number of retainees, however, this would bring the overall teacher-pupil ratio to .047. A substantial fraction of available discretionary funds would be used to hire new teachers even though there are no terminating teachers to replace. Had TNO1 been only .032 originally, however, and equal to RTNO, this would have affected hiring of new teachers by a much smaller amount. The estimated value of HTNO would then have been .0087 and the final teacher-pupil ratio would have been .041. The compensating response of a school district to a decrease in the number of retainees is considerably stronger than the "habit formation" response to a change in the base-year value.

REGRESSION EQUATIONS FOR INCREASE IN NONTEACHER SPENDING PER PUPIL

Regression equations for DOTH, the increase in expenditure per pupil for all resources other than teachers between 1968-69 and 1969-70 are shown in Table 20. Two equations are shown for each of the four discretionary budget concepts. Each relationship includes amoung its independent variables the three main variables of the HTNO regressions, DBD, TNO1, and RTNO, and also XOTH1, the base-year value of spending for resources other than teachers. The first equation in each pair includes these four variables only; the second equation adds the four SES variables, EMPH, EMPM, BLCK, and CITY. As in the equations for HTNO, the combination of TNO1 and RTNO proved superior to the difference between them, DTNO, in every instance; therefore, versions containing DTNO only are not shown. The clerical income variable contributed nothing to the equations and does not appear in any of the relationships selected for the table.

A conspicuous result in this set of equations is that estimates of the DBD coefficient are only slightly affected when the definition of discretionary budget is changed, while estimates of the coefficient of prior year spending for resources other than teachers, XOTH1, are affected drastically. Referring to the definitions of DBD1 through DBD4 in Chapter V, we can see that year 1 outlays for nonteacher spending are not subtracted from the year 2 budget in computing DBD1 and DBD2, whereas they are subtracted in computing DBD3 and DBD4. The consequence is that the estimated XOTH1 coefficients are much smaller in absolute terms when the latter two definitions are used and are much less significant. The TNO1 and RTNO coefficient values are also affected by the choice of definition. The values of these two coefficients are much different in the DBD3 equations than in any of the others. The overall fit of the equation also depends on which discretionary budget concept is used, but not in such a way that a case

Table 20

REGRESSION EQUATIONS FOR INCREASE IN PER PUPIL SPENDING FOR RESOURCES OTHER THAN TEACHERS, 1968-69 TO 1969-70

Equation	Constant	Discretionary Budget (DBD)		Other Expenditures per Pupil In Base Year (XOTH1)	Teacher Pupil Ratio in Base Year (TNO1)	Retained Teacher to Pupil Ratio (RTNO)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	R^2	F
		Version	Coeff.									
1	-.087 (-5.0)	1	.00060 (26.6)	-.00069 (-19.2)	-2.4 (-5.5)	4.1 (10.7)					.86	296
2	-.087 (-3.6)	1	.00059 (25.6)	-.00070 (-19.3)	-1.8 (-3.7)	3.9 (10.7)	-.053 (-1.9)	-.018 (-0.4)	.035 (1.4)	.015 (1.9)	.87	161
3	-.099 (-5.4)	2	.00065 (24.6)	-.00064 (-17.2)	-2.9 (-6.2)	5.2 (13.4)					.84	257
4	-.108 (-4.1)	2	.00063 (23.6)	-.00066 (-17.4)	-2.3 (-4.5)	5.0 (13.1)	-.037 (-1.2)	-.011 (0.2)	.049 (1.8)	.019 (2.2)	.86	140
5	-.058 (-2.9)	3	.00082 (22.1)	-.00011 (-3.0)	-8.2 (-13.9)	9.3 (22.2)					.82	211
6	-.050 (-1.8)	3	.00079 (21.1)	-.00014 (-3.4)	-7.3 (-11.7)	9.0 (21.3)	-.054 (-1.6)	-.041 (-0.8)	.054 (1.8)	.009 (0.9)	.83	115
7	-.087 (-5.0)	4	.00060 (26.6)	-.00009 (-2.7)	-2.4 (-5.5)	4.1 (10.7)					.86	296
8	-.086 (-3.6)	4	.00059 (25.6)	-.00011 (-3.2)	-1.8 (-3.7)	3.9 (10.7)	-.053 (-1.9)	-.018 (-0.4)	.035 (1.4)	.015 (1.9)	.87	161

NOTES: Sample size is 194. Numbers in parentheses are t-values. DOTH, DBD, and XOTH1 are measured in \$1000's Equations are in linear form. The dependent variable is the increase in per pupil spending for other resources (DOTH).

can be made for or against deducting XOTH1 in computing the discretionary budget. Statistics of fit and estimates of the DBD coefficients are almost identical in the equations containing DBD1 and DBD4. The DBD3 equations are the poorest. In defining DBD3, it was assumed that the district is constrained in year 2 to spend the total year 1 expenditure for "other," not the year 1 per pupil amount. Based on these results, that assumption is unsound.

The hypotheses that DOTH is positively related to DBD and RTNO and negatively related to TNO1 and XOTH1 are all very strongly supported no matter which DBD definition is used. In addition, there are marginally significant positive effects on DOTH of BLCK and CITY and a marginally significant negative effect on DOTH of EMPH. The effect of CITY on DOTH is always opposite to the effect of the same variable on HTNO, which means that city school districts tend to use the money saved by hiring fewer new teachers to buy other resources. Effects of the other SES variables on HTNO are not offset by opposite effects on DOTH, which means that they must be offset instead by changes in the teacher salary variables. The negative effect of EMPH, but not the effects of the other SES variables, is consistent with the results of the cross-sectional regressions for spending on "other" resources (Tabels 4 and 5). Both the equation R^2s and the t-values for the main variables are very high in all relationships shown in Table 20.

REGRESSION EQUATIONS FOR THE INCREASE RATE IN THE TEACHER SALARY SCHEDULE

Table 21 displays selected equations in which the dependent variable is ALPH, the fractional increase in the level of the teacher salary schedule between 1968-69 and 1969-70. The procedure for estimating values of ALPH for each district from the constructed salary schedules for the two school years was explained in Chapter V. Two equations each are shown for definitions 2, 3, and 4 of the discretionary budget per pupil. The equations containing DBD1 were poor and are not displayed.

In this instance, equations containing the discretionary budget variable DBD3 perform best in terms of overall fit, with R^2s in the .30 range as compared with values of about .20 when definitions 2 and 4 are used. The DBD3 equations also yield very different estimates of the main coefficients than the DBD2 and DBD4 equations. An exogenous increase

Table 21

REGRESSION EQUATIONS FOR INCREASE IN LEVEL OF THE TEACHER SALARY SCHEDULE, 1968-69 TO 1969-70

Equation	Constant	Discretionary Budget (DBD)		Teacher Pupil Ratio in Base Year (TNO1)	Retained Teacher to Pupil Ratio (RTNO)	Log of Teacher Starting Salary (STR)	Log of Clerical Income (CLRY)	Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minority (BLCK)	Dummy Variable for City (CITY)	R^2	F
		Version	Coeff.										
1	.42 (6.5)	2	.21 (4.8)	-1.2 (-1.4)	-1.8 (-2.8)	-.043 (-5.0)						.18	10
2	.39 (5.7)	2	.24 (4.9)	-1.1 (-1.2)	-1.5 (-2.2)	-.046 (-5.3)	.007 (0.9)	-.060 (-1.1)	.009 (0.1)	-.064 (-1.3)	-.011 (-0.7)	.20	5
3	.44 (7.4)	3	.42 (7.5)	-4.0 (-4.6)	.68 (1.1)	-.042 (-5.4)						.29	19
4	.41 (6.4)	3	.43 (7.5)	-4.1 (-4.2)	.99 (1.5)	-.045 (-5.6)	-.011 (1.4)	-.033 (-0.6)	.004 (0.0)	-.038 (-0.9)	-.011 (-0.7)	.31	9
5	.41 (6.4)	4	.21 (5.0)	-.97 (-1.2)	-1.5 (-2.4)	-.039 (-4.7)						.18	11
6	.38 (5.5)	4	.22 (5.0)	-.91 (-1.0)	-1.4 (-2.0)	-.042 (-4.9)	-.012 (1.5)	-.026 (-0.5)	.013 (0.1)	-.031 (-0.7)	-.004 (-0.3)	.20	5

NOTES: Sample size is 194. Numbers in parentheses are t-values. DBD, STR, and CLRY are measured in $1000's. Equations are in linear form. The dependent variable = the rate of increase in the level of the teacher salary schedule (ALPH).

in discretionary budget per pupil equal to 10 percent of the mean budget level ($70) would be associated with an increase of about 1.5 percent in the level of the salary schedule (.22 x .070 = .0154) according to the DBD2 and DBD4 relationships and with about twice that increase according to the DBD3 equations (.43 x .070 = .030). The smaller estimate is much more in agreement with the finding from the cross-sectional analysis that average salary increases by about 1.6 percent when budget is increased by 10 percent, holding average experience and educational levels of teacher constant (see Chapter IV). There are even larger disparities between the estimates of the coefficients of TNO1 and RTNO when different discretionary budget variables are used in the equations. In fact, the estimated coefficient of RTNO in the equations containing DBD3 is positive, contrary to our hypothesis (although only marginally significant), whereas the estimates in the equations containing DBD2 and DBD4 are negative, as expected. Thus, there is reason to be skeptical of the estimates from equations containing DBD3 despite their higher R^2s. Moreover, these doubts are reinforced by the somewhat anomalous results obtained when DBD3 is used to explain the other dependent variables.

One point on which all equations in Table 21 agree closely is the estimate of the effect of year 1 starting salary on the rate of salary schedule increase; the coefficient of STR1 in all six equations ranges between -.039 and -.046. The coefficients are highly significant, and the negative sign is as hypothesized. The hypotheses that TNO1 and RTNO are negatively related to ALPH are also supported, except in the case of the one DBD3 equation referred to above. Neither clerical income nor any of the SES variables has a significant effect on the rate of salary schedule increase. No direct comparison with the cross-sectional results is possible because the dependent variable (ALPH) is a composite measure of increases in the three salary schedule parameters--starting salary, experience increment, and degree increment.

REGRESSION EQUATIONS FOR ENTRY SALARIES OF NEWLY HIRED TEACHERS

One budgetary decision over which districts probably have considerable discretion is the entry salary of new teachers. Although it would be possible for a district to hire only new teachers having B.A. degrees and no experience, that is not the typical pattern. In most districts, at least some newly hired teachers have teaching experience or more than the minimal educational qualifications or both. The variable DSLH measures the fraction by which the average salary paid to newly hired teachers exceeds the district's starting salary. It is of interest to see whether districts vary in DSLH according to the size of their discretionary budget and other variables, including especially the experience and educational levels of the already-employed (retained) teaching force. Information on this point would be much more revealing about district officials' preferences with respect to experience and education than any information obtainable from a cross-sectional analysis. With a cross-sectional design, one can only estimate the joint effects of district hiring decisions and individual teacher termination decisions; the incremental approach makes it possible to separate the two and to focus on the district's own choices.

Regression equations with DSLH as the dependent variable are presented in Table 22. The equations shown reflect two concepts of the discretionary budget, DBD2 and DBD4, and contain the following independent variables: discretionary budget (DBD), teacher-pupil ratio in the base year (TNO1), retained teacher-pupil ratio (RTNO), starting salary (STR), and the fraction by which the average salary of retainees exceeds the starting salary (DSLR). Some versions also include DSL1, the fraction of which the average salary of all year 1 teachers exceeds the starting salary, and the four socioeconomic indicators. The results obtained from the equations containing DBD2 and DBD4 are almost identical. Therefore, the statements made below refer to either set of relationships.

Regardless of the form of the equation, it appears that the sensitivity of DSLH to the size of the discretionary budget is low: Elasticity estimates are all about .10, which means that doubling the discretionary budget per pupil would result in only a 7 percent increment in DSLH. Moreover, the DBD coefficients are only marginally significant. Thus, it does not appear to be true that districts with more unrestricted money to spend use that money to upgrade the experience or educational levels of their teaching staffs. There is a positive relationship between DSLH and teacher-pupil ratio in year 1, and a negative relation-

Table 22

REGRESSION EQUATIONS FOR THE FRACTION BY WHICH AVERAGE SALARY OF NEWLY HIRED TEACHERS EXCEEDS STARTING SALARY, 1969-70

Equation	Con-stant	Discretionary Budget (DBD)		Teacher Pupil Ratio in Base Year (TN01)	Retained Teacher to Pupil Ratio (RTNO)	Log of Teacher Start-ing Salary (STR)	Ratio of Average Salary to Start-ing Salary		Percent High-level Empl. (EMPH)	Percent Mid-level Empl. (EMPM)	Percent Minor-ity (BLCK)	Dummy Vari-able for City (CITY)	R^2	F
		Version	Coeff.				Retained Teacher (DSLR)	Base-year Teachers (DSL1)						
1	.067 (0.7)	2	.11 (1.7)	4.6 (3.9)	-2.4 (-2.6)	-.035 (-2.8)	.26 (4.6)						.25	12
2	.16 (1.6)	2	.12 (1.8)	3.5 (2.7)	-2.3 (-2.4)	-.031 (-2.5)	.28 (4.8)		-.067 (0.9)	-.27 (-2.3)	-.10 (-1.5)	.002 (0.1)	.28	8
3	.18 (1.7)	2	.12 (1.9)	4.5 (3.5)	-2.5 (-2.7)	-.031 (-2.6)	.39 (5.0)	-.16 (-2.4)					.27	11
4	.26 (2.9)	2	.14 (0.2)	3.2 (2.5)	-1.9 (-2.0)	-.046 (-3.3)	.40 (5.1)	-.15 (-2.2)	.081 (1.0)	-.23 (-1.9)	-.10 (-1.4)	.002 (0.1)	.30	8
5	.054 (0.6)	4	.10 (1.6)	4.6 (4.0)	-2.3 (-2.5)	-.033 (-2.7)	.28 (5.1)						.24	12
6	.15 (1.5)	4	.10 (1.7)	3.5 (2.7)	-2.2 (-2.4)	-.028 (-2.3)	.29 (5.0)		.084 (1.1)	-.26 (-2.2)	-.08 (-1.2)	.005 (0.2)	.28	8
7	.15 (1.5)	4	.10 (1.7)	4.5 (3.8)	-1.8 (-1.9)	-.046 (-3.4)	.40 (5.1)	-.15 (-2.2)					.26	11
8	.23 (2.2)	4	.10 (1.7)	3.3 (2.6)	-1.8 (-1.9)	-.041 (-3.0)	.40 (5.1)	-.14 (-2.0)	.10 (1.3)	-.22 (-1.8)	-.08 (-1.1)	.006 (0.3)	.29	8

NOTES: Sample size is 194. Numbers in parentheses are t-values. DBD and STR1 are measured in $1000's. Equations are in linear form. The dependent variable is the fraction by which average salary paid newly hired teachers exceeds starting salary (DSLH).

ship between DSLH and the ratio of retained teachers to pupils in year 2. This implies that the larger the autonomous year-to-year decline in the number of teachers per pupil, i.e., the more teachers needing to be replaced, the less will be the district's tendency to hire new teachers with more than minimal qualifications. The fact that the TNO1 coefficient is greater than the RTNO coefficient shows that districts with high initial teacher-pupil ratios (which are usually higher spending districts) tend to hire more experienced or more educated new teachers. The negative coefficient of STR1 indicates that where starting salaries are high, there is less tendency to employ teachers who will be located higher on the salary scale.

Effects of the DSLR and DSL1 variables on DSLH are contrary to our hypothesis and are difficult to interpret. Districts that pay their retained teachers considerably in excess of starting salary--i.e., districts with high DSLR--also pay newly hired teachers substantially above the minimum. This seems to refute the notion that a district seeks to maintain a certain experience-education mix in its teaching staff. Instead, districts that already have highly experienced or highly trained staffs appear to hire new teachers who are themselves more experienced or educated than typical new teachers. The tendency is to maintain a homogeneous teaching force rather than to offset initially high or low experience or educational levels by means of appropriate selection of new teachers. The estimated DSL1 coefficient is negative, which means that districts with highly experienced or highly trained teaching staffs during the base year are less likely than other districts to hire new teachers with more than minimal experience and training. This result, by itself, appears consistent with the theory of the optimum experience-education mix. However, when the DSLR and DSL1 coefficients are examined together, this consistency disappears. Since the absolute value of the DSLR coefficient is greater than that of the DSL1 coefficient, the equation implies that the more successful a district is in retaining its more experienced, better educated teachers, the more likely it will be to hire experienced, well-trained new teachers. Conversely, the less success a district has in retaining its most qualified teachers, the fewer experienced, well-trained replacements it will employ. These results are not satisfying and they seem incompatible with a theory of rational allocative behavior by school districts. On the other hand, they are compatible with a theory of choice by individual teachers. If the composition of the teaching force--and of the newly hired teachers, in particular--reflects a "sellers' market" in which the choices of individual teachers are the main determinants of employment patterns, then it is not unreasonable that districts able to retain their experienced, well-trained teachers would also be able to recruit highly qualified newcomers and that districts having difficulty in retaining their higher-level teachers would also find it difficult to recruit experienced, highly-educated replacements. The design of this study does not permit us to choose among alternative explanations of these unexpected results.

The only SES variable with a significant effect on DSLH is EMPM, middle-level employment. The implication of the negative coefficient is that there is a greater tendency to hire more experienced or more educated teachers in low-SES or high-SES neighborhoods than in those of intermediate status. These results are consistent with the strong negative effect of EMPM found in the cross-sectional relationships for average teacher experience (Tables 16 and 17).

OVERALL FINDINGS FROM THE DISCRETIONARY BUDGET ANALYSIS

Taken as a whole, the statistical results reported above support the validity of the discretionary budget formulation. The equations for the number of newly hired teachers per pupil and for per pupil expenditures on nonteacher resources perform exceptionally well, especially considering that local governments are subject to many short-run fluctuations and perturbations that can reduce the explanatory power of models of year-to-year change. The explanatory power of equations for the rate of salary change and for the average position of newly hired teachers on the salary schedule is not as good, but this is not surprising in view of the somewhat artificial methods by which some of the dependent and independent variables were constructed. The relationships between dependent variables and several important independent variables--the size of the discretionary budget, the price variables, and the autonomous change in the teacher-pupil ratio--emerge clearly in all cases. All hypotheses about the signs of effects of independent variables are confirmed, except the two hypotheses about determinants of the average salary schedule position of new hires (DSLH), that were discussed above. The results of this analysis are generally consistent with the results of the cross-sectional analysis, reported in Chapters II through III. There is no direct evidence that allocative outcomes are altered significantly by inherited resources and school districts' precommitments of funds; however, this method of analysis does not provide a definitive test of the existence or importance of allocative constraints.

VII. INTEGRATION OF FINDINGS AND CONCLUSIONS

In this final chapter, we seek to accomplish three tasks: first, to bring together the main quantitative results of the analysis and to provide a comprehensive illustration of how school districts are likely to use incremental funds; second, to summarize what has been learned about the determinants of budgetary outcomes in school districts, apart from the specific quantitative results; and third, to review the principal limitations of the methods used in the study and to suggest possible methodological improvements for the future.

INTEGRATION OF FINDINGS

Review of Main Quantitative Results

The following is a point-by-point restatement of the principal quantitative findings of this study concerning the responses of school district budget allocations to changes in the level of funding per pupil.

1. Our cross-sectional results for both the 1969-70 and 1968-69 school years and Alexander's California results all support the conclusion that expenditure per pupil for teachers increases at only three-fourths the rate of total current spending per pupil. It follows that the share of the school district budget expended for teachers falls as the size of the budget increases, and that a smaller fraction of each successive budget increment is expended for teachers. In relation to possible school finance reforms, the implication of this conclusion is that a shift of funds from higher-spending to lower-spending districts ("equalization") would tend to increase aggregate outlays for teachers.

2. The teacher-pupil ratio of a school district increases by about one-half of one percent for each one percent increase in total per pupil spending. This result is roughly consistent with Alexander's estimate for California, if certain differences in definitions and samples are allowed for. Average teacher salary increases at only about three-fifths the rate of the teacher-pupil ratio as the budget increases. A substantially larger share of each budget increment is spent to increase the teacher-pupil ratio than to increase staff pay.

3. The ratio of total staff (teachers, administrators, and specialists) to pupils increases at about a 10 percent greater rate than the pupil-teacher ratio in response to a given increase in the budget. Outlays for administrators increase slightly less than in proportion to the budget; outlays for specialists increase at a rate 40 percent greater than the rate of increase in the budget.

4. Of the total increase in average teacher salary associated with an increase in the budget, slightly more than half is attributable to increases in salary schedule parameters (in an "average" district); slightly less than half is attributable to increases in average teacher experience and in the percentage of teachers with advanced degrees.

5. Of the three salary schedule parameters, starting salary is the least sensitive to the budget level. It increases by only .15 percent for each one percent increase in total per pupil expenditure. The increment paid per year of experience increases more rapidly (estimates range from .20 to .40 percent for each one percent increase in the budget) and the increment paid for an M.A. degree increases most rapidly (.50 to .66 percent for each one percent increase in the budget). The results pertaining to the first two parameters are roughly consistent with Alexander's. The result pertaining to the degree increment parameter is not directly comparable with Alexander's and is suspect because of shortcomings in the method used to estimate the degree increment paid by each district.

6. Both the average number of years of teacher experience and the percentage of teachers with M.A. degrees tend to be higher in high-spending districts. The former increases by about one-third of one percent for each one percent increase in the budget, and the latter increases at a rate 20 percent greater than the rate of increase in the budget. Nevertheless, when we combine these results with the results pertaining to salary schedule parameters, we find that increases in the rewards paid for experience account for approximately three times as large a share of an increment in the budget as increases in premiums paid for M.A. degrees.

7. Estimates from the discretionary budget analysis of the effects of an increase in the amount of discretionary money per pupil on the number of newly hired teachers per pupil, the increment in per pupil spending for

nonteacher resources, and the rate of increase in the salary schedule are consistent with cross-sectional estimates of school district responses to budget increments, at least for an "average" district.

Allocation of an Incremental Dollar per Pupil

The implications of the foregoing findings can be illustrated by tracing through the disposition of an incremental dollar in total per pupil spending in a district that initially has a $700 per pupil budget (the sample mean value) and average values of all other district characteristics. According to the cross-sectional results for 1969-70,[1] an additional dollar per pupil will be distributed among the four expenditure categories in the following proportions:

o Increment in per pupil spending for teachers	48.0 cents
o Increment in per pupil spending for administrators	6.4 cents
o Increment in per pupil spending for specialists	4.1 cents
o Increment in per pupil spending for other resources	41.5 cents

Of the additional 48 cents per pupil expended for teachers,

o The increase in the teacher-pupil ratio accounts for	30.9 cents
o The increase in average teacher salary accounts for	17.8 cents.[2]

Of the approximately 18 cents per pupil spent on higher average salaries, approximately 10.5 cents is accounted for by increases in the parameters of the teacher salary schedule. The breakdown is:

---

[1] The illustrative results reported here are based on the following regression equations (identified by table number and equation number): 2-6, 4-A2, 4-S2, 4-O2, 7-2, 9-4, 11-2, 14-S3, 14-D3, 14-E3, 16-X2, 16-M2.

[2] Expenditure components do not always sum exactly to totals partly because of rounding errors and partly because of discrepancies between regression equations.

o Per pupil cost of increasing teacher starting salary	6.5 cents
o Per pupil cost of increasing the reward for each year of teaching experience	3.2 cents
o Per pupil cost of increasing the premium for an M.A. degree	0.8 cents

Approximately 7.6 cents of the 18 cents per pupil that is used to increase average teacher salary is accounted for by increases in average teacher experience and training. This consists of

o Per pupil cost associated with increased experience	5.6 cents
o Per pupil cost associated with a higher percentage of M.A. degrees	2.0 cents.

Three outcomes that deserve emphasis, especially in light of the concern that has been expressed that expenditure increases will be absorbed by higher salaries, are (1) that less than half of an increase in per pupil outlays (48 percent) tends to be spent on teachers; (2) that of the additional expenditure for teachers, a larger share (63 percent) is accounted for by increases in the teacher-pupil ratio than by increases in average teacher salary; and (3) that only slightly more than half of the amount consumed by increases in average salaries is accounted for by upward movement of the salary schedule; the remainder is used to hire more experienced and more educated teachers. Out of a one dollar per pupil increase in the budget, only 10.5 cents, on average, tends to be spent to raise the level of the teachers' salary schedule. Although the numerical findings of Alexander's study differ from ours in a number of respects, his conclusions about these important points are very similar.[1]

CONCLUSIONS ABOUT THE DETERMINANTS OF BUDGETARY OUTCOMES

Although we did not set out initially to test and compare alternative theoretical models of resource allocation behavior, some of the findings from both the cross-sectional and discretionary budget analyses are suggestive about the nature of school district budgetary choice. In this section, we offer several tentative conclusions and conjectures based on our interpretations of the regression results. Since the design of this study did not provide a basis for rigorous hypothesis testing, nor for discriminating among alternative explanations of certain empirical outcomes, the propositions advanced here should be viewed as candidates for further testing in the context of an appropriately focused, more detailed analysis.

---

[1] Alexander, p. 24.

Constrained Maximization and Habit Formation Models

Many of the empirical findings summarized above are fully consistent with a demand-theoretic, constrained maximization model of school district choice of the kind referred to in the Introduction and discussed at greater length in the Appendix. This is true, in particular, about findings pertaining to the allocation of the budget among expenditure categories and to the determinants of teacher-pupil and staff-pupil ratios. However, not too much can be made of this conclusion because the constrained maximization model is such an unrestrictive one: All that it requires is that the amount purchased of each resource should be positively related to the size of the budget and negatively related to the resource's price.

Evidence from the discretionary budget analysis suggests that the constrained maximization model, even if basically correct, is incomplete. Specifically, the finding about the dependence of the number of newly hired teachers on the teacher-pupil ratio in the prior year implies that the "habit formation" hypothesis is valid and should be appended to the basic constrained maximization framework. The dependence of current-year resource allocation decisions on the prior-year teacher-pupil ratio (holding the size of the budget and the number of teachers needing to be replaced constant) can be interpreted in three different ways: (1) Past experience determines the school district's "taste" for teachers relative to other resources (literally, habit formation); (2) prior-year allocations reflect district tastes and thereby provide extra information about the nature of the school district's preference function; (3) the relationship between prior-year and current-year resource allocations reflects lags in the adjustment process, due either to explicit or implicit constraints on district choices or to organizational inertia. The conclusion that prior-year variables are significant, independent determinants of resource allocation behavior does not mean that the constrained maximization approach is invalid. It does mean that lagged resource variables should be taken into account in future studies, and it confirms the usefulness of focusing on year-to-year changes in resource allocation patterns.

Determinants of Teachers' Salaries

The weak association of teacher starting salary with the level of the school district budget suggests that starting salary depends primarily on labor market conditions in the area of each school district. Moreover, it is possible that even the small positive relationship between starting salary and budget in our equations has been exaggerated by failure to include other variables that represent labor market conditions. For instance, on theoretical grounds one would expect both the level of per pupil spending and the starting salary of teachers to be positively related to the cost of living (general price index) in each school district. Also, it is likely that there are other variables, not present in our data base, which are related to both the level of per pupil spending in a district and the district's attractiveness to teachers, and that may account for part of the positive relationship between budget level and starting salary. Because the correlation between starting salary and per pupil spending is so low, it is possible to use both variables as independent variables in the regression equations without biasing the coefficient of either. This is confirmed by the finding that coefficients of the budget variable do not change when starting salary is introduced into the regression equations for expenditure components and for teacher-pupil and staff-pupil ratios.

The salary schedule as a whole is more sensitive to the budget level than is starting salary. However, we do not know whether this reflects attempts by higher-budget districts to attract more experienced and better-trained teachers or whether it is another labor market phenomenon, reflecting greater competition for more highly qualified employees than for new college graduates in higher-spending districts. The positive relationship between the salary increments paid for each year of experience and for the

M.A. degree and the level of clerical income in the school district tends to support the latter interpretation.

Some of the results pertaining to the average experience level of teachers and the percentage of teachers with M.A. degrees appear inconsistent with the propositions that (a) school districts are rational constrained maximizers and (b) school districts are free to choose teachers with the characteristics that the district considers desirable. The key finding on this subject is from the discretionary budget analysis. Contrary to our hypothesis, we found that a school district's tendency to hire experienced, well-trained new teachers is positively related to its success in retaining experienced, well-trained teachers from the previous year. According to the constrained maximization model, a negative relationship would be expected. However, the positive relationship is compatible with an alternative model in which (a) districts do not choose teachers, but teachers choose districts and (b) the presence of experienced, well-trained teachers in a district indicates that the district is an attractive workplace for teachers with those characteristics. Certain otherwise puzzling results of the cross-sectional analysis are also compatible with a teacher-choice model. Therefore, we conclude that a prima facie case has been made that the average levels of experience and training of a school district's teaching staff are determined primarily by decisions of the teachers themselves, rather than by school district officials.

LIMITATIONS

Causal Inference

Caution and selectivity are called for in making causal inferences from the empirical findings of this study. The usual strictures about inference from cross-sectional regression models ("correlation does not imply causation") are applicable. In addition, the study has certain special characteristics, some favorable and some unfavorable to inference, that need to be taken into account.

Cross-sectional models often do not yield clear-cut conclusions about cause and effect relationships. Sometimes the direction of causation is uncertain; in other cases, the statistical relationship between two variables may be due to a third variable that influences both. Where the latter explanation applies, it is easy to infer incorrectly that an exogenous change in the independent variable will have the effect on the dependent variable implied by the regression coefficient. In this study, we have investigated differences in resource allocation patterns among school districts with budgets of different sizes. To use that information for prediction, we need to assume that an initially low-spending district that succeeds in obtaining additional money will begin to behave like a district that had more money all along; that is, we must assume that differences in the budget cause differences in allocative outcomes. In the absence of a strong theoretical model, cross-sectional evidence is normally not enough to support that conclusion.

A characteristic of this study that favors causal inference is that some of the findings of the cross-sectional analysis are confirmed by the results of the incremental, discretionary budget analysis. Specifically, findings from the discretionary budget analysis about year-to-year changes in the teacher-pupil ratio and in per pupil spending for nonteacher resources are consistent with what would have been predicted from the cross-sectional regressions. This provides some assurance that information obtained by comparing different districts in a single year can be used to estimate district responses to changes in their budgets from one year to the next. Unfortunately, the discretionary budget analysis supports only some of the cross-sectional results; the evidence pertaining to other dependent variables of the study is far less encouraging.

In the immediately preceding section of this chapter, we concluded that there are good reasons to doubt that changes in school district budgets have the effects on average teacher experience and training that are implied by the cross-sectional regression equations. Some of the empirical findings are consistent with the alternative theory that average experience and training are determined mainly by decisions of individual teachers, and that the statistical relationship between those variables and the size of the budget exists because per pupil spending is correlated with factors that make districts attractive to teachers. If this theory is correct, then average levels of teacher experience and training would not necessarily respond to changes in school district budgets. Moreover, even if a high level of spending, in itself, makes a district attractive to teachers, the response to a change in the level of spending would take place through the teacher termination and replacement process. It would be incorrect to infer that districts necessarily set out to raise the experience and training levels of their teachers when additional funds are made available.

A second factor unfavorable to causal inference is that the study's findings about determinants of teacher salary schedules do not rule out the proposition that salary schedule parameters respond mainly to market conditions. Some of the positive relationship between the salary schedule parameters and the level of per pupil spending in a district may be attributable to omission of relevant variables, such as the cost of living (general price level) in a district. For example, if the positive relationship between teacher starting salary and budget is really due to positive effects of the cost of living on both variables, it would be incorrect to infer that an increase in the budget will raise starting salaries.

A third unfavorable factor is that the regression equations for average teacher experience and training and for the starting salary parameters explain only a small fraction of the variance in their dependent variables. This leaves open the possibility that omitted variables are important, and that the apparent effects of the level of per pupil spending would be altered if omitted variables were included.

The upshot is that there appears to be a reasonable basis for inferring that budget increments will lead to changes in expenditure composition, teacher-pupil ratio, and staff-pupil ratio of the kinds implied by the regression equations. There is less basis for predicting that salary schedules will respond to funding changes in the manner implied by the regression equations for salary schedule parameters. There are good reasons to believe that responses of average teacher experience and degree level cannot be inferred from the regression equations for those two dependent variables.

Prediction

Apart from the problems of inference cited above, there are several other limitations on the usefulness of the findings of this study for predictive purposes. One is that the findings are based on data for the 1968-69 and 1969-70 school years. Even if the analysis were otherwise flawless, changes in conditions during the past five years would undoubtedly have made some of the results inapplicable to the current situation. Among other things, the nature of the market for school teachers has been altered drastically. As a result of overproduction by the teacher training institutions and declining pupil enrollments in the public schools, there is a large teacher surplus. A "buyers' market" now exists that is very different from the teacher market of the 1968-70 period. It is quite likely that the change in market conditions has affected school district propensities to hire teachers, to respond to the wage offers of the private sector, and to offer rewards for experience and training. In addition to the shift in market conditions, many other circumstances affecting school districts are different than they were during the period covered by our data. Levels of school spending have risen, both absolutely and relative to other expenses. Price levels have also risen sharply and, during the past few years, have continued to rise at greater than historical rates. Demographic changes have not only put a stop to enrollment growth but have significantly altered the composition of the pupil population in many parts of the country. Important changes have also taken place in state school finance systems--in some instances, in response to court orders to equalize school finances among the individual districts within a state. For all these reasons, a model that was valid in 1969-70 may now have little predictive value. Therefore, a minimum step to take before using the model for prediction or policy analysis would be to reconform the basic findings and to recalibrate the equations using more current data.

The changes that are taking place in state school finance systems raise other issues. In carrying out our analysis, we examined school district responses to changes in budget levels, without regard to the source of funds or the mode of financing. To the extent that the funds available to Michigan school districts during the 1968-69 and 1969-70 school years were provided without strings and to the extent that funds are still available on that basis, no special problem is created. However, in an era of school finance reform, it is possible that modes of financing may change in ways that will significantly affect school district responses. For example, state school finance reform legislation could provide for reorganization or modification of educational programs or staffing practices in conjunction with a redistribution of funds. Also, outside financial support could be tied to particular uses of funds. If such structural changes accompanied financial reform, the relationship between resource allocation patterns and funding levels could be altered. In future studies of this kind, it may be desirable to take this possibility into account by including sources of funds and modes of financing among the independent variables of the model.

Analysis of the Market for Teachers

The weakest part of this study is the analysis of the components of average teacher salary--average experience, average degree level, and the three salary schedule parameters. A probable explanation of the relatively poor performance of the regression equations for these variables is that the analysis is incomplete. It does not include the supply side of the teacher market. Although it was not explicitly assumed in developing the cross-sectional model that the five dependent variables are determined by school district officials, that assumption is implicit since nothing in the model represents the behavior of teachers. To sort out the various factors that determine teacher salaries and teacher characteristics, it may be necessary to develop explicit models of both the behavior of currently employed teachers and the supply of new teachers to school districts.

In the discretionary budget analysis, we took two steps toward development of a teacher supply model: First, we differentiated between retained teachers and new teachers; second, we separated the teacher's decision to remain employed from one year to the next from the district's decision about the number of new teachers to be hired. That foundation can be built on in developing a more complete supply-demand model. One necessary component of a complete analysis is an explicit model of teacher retention and termination. Among the factors likely to be important in in such a model are the age and experience structure of the existing staff, the school district salary schedule (especially the increments paid for experience and training), wage rates in alternative occupations in the district's market area, and other variables that represent the attractiveness of a district to its teachers. Another component is a model of the supply of new teachers. Such a model must take account of labor market conditions (aggregate shortage or surplus in the teacher market, rates of employment in the community, and wage rates in alternative occupations) and the same attractiveness indicators as in the retained teacher model. The demand side of the model may also need to be elaborated to permit a more complete representation of district preferences for teachers with different combinations of experience and training. In order to sort out the various factors influencing teacher market outcomes, it will probably be necessary to develop a multiequation model in which the demand and supply equations retain their separate identities (i.e., a "structural" as opposed to a "reduced form" model). Improved data would also be needed to carry out the analysis. A data source like the Michigan Professional Personnel Register provides adequate information on employed teachers, but additional information is needed on the total supply of teachers in each market area and on such factors as alternative wage levels, unemployment rates, and cost of living.

Development of a model of this kind would obviously be a major undertaking. However, the findings of this study strongly suggest that only a complete supply-demand model will provide the means of predicting the impacts of financial changes on teaching staffs and teacher salary schedules.

Appendix

THEORETICAL MODELS OF SCHOOL DISTRICT RESOURCE ALLOCATION BEHAVIOR

This appendix presents a discussion of the theoretical models that were considered before embarking on the empirical analysis of school district budget allocation. As explained in the Introduction, we did not attempt to rigorously test a fully specified model of budgetary choice. Nevertheless, the models described here were drawn on extensively in formulating the regression equations presented in Chapters II through VI and in interpreting the results.

BASIC APPROACH AND ASSUMPTIONS

The economic theory of constrained maximizing behavior has been applied repeatedly to analyses of budget determination in school districts and, more recently, to the problem of budget allocation as well.[1] The basic premise of a maximizing model of school district resource allocation is that district decisionmakers (the administrators and school board members who control the budget) try to spend their money in a way that maximizes a function of desired outcomes or resource-use characteristics of districts. Their attempts at maximization are limited by revenue availability and by the terms on which resources are supplied. To formulate a specific constrained maximization model, one must specify what the district seeks to maximize, how purchased resources are related to goal attainment, and under what conditions or constraints officials make allocative choices. From these assumptions and the standard rules of inference for microeconomic constrained maximization models, it becomes possible to draw the same kinds of implications about district responses to changes in available income (budget) and price variables (such as teachers' salaries) as in the economics of private sector consumer demand.

---

[1] For a review of the constrained maximization models used to analyze school district budget determination, see S. M. Barro, *The Impact of Intergovernmental Aid on School District Spending*, Ph.D. dissertation, Stanford University, 1974, Chapter II. Examples of applications of constrained maximization theory to the budget allocation problem include Byron W. Brown, "Achievement, Costs, and the Demand for Public Education," *Western Economic Journal*, Vol. 10, No. 2, June 1972, pp. 198-219, and Byron W. Brown and Daniel H. Saks, "The Production and Distribution of Cognitive Skills Within Schools," *Journal of Political Economy*, Vol. 83, No. 3, June 1975, pp. 571-593.

As is true in microeconomics generally, the assumption of maximizing behavior is not meant to be taken as a literal description of the decisionmaking process in a school district. The theory does not rest on the obviously unrealistic premises that officials quantify goals and trade-offs among them, that they understand the connections between goals and specific allocative decisions, or that they actually perform optimality calculations. Rather, it is assumed that officials, in seeking to advance their own interests, inadvertently behave *as if* they were seeking the optimal allocation of available funds. Thus, their long-run tendency, even in the face of uncertainties, information gaps, and local perturbations, is to approach the allocative pattern that would be adopted by a conscious, well-informed maximizer. The principal limitation of models based on this assumption is that, strictly speaking, they apply only to equilibrium states, but that has not proved to be a disabling qualification in consumer demand economics. Moreover, this limitation can be relaxed by adding explicit propositions about the process of adjustment to equilibrium. Certain types of adjustment behavior are implicit in the modified model that underlies the discretionary budget analysis presented in Chapters V and VI.

Although the basic assumption of the constrained maximization model is self-interested maximizing behavior, we make no attempt to spell out precisely what the interests of school district officials are. Presumably, they are a blend of political motives (producing educational results or providing services that please the voters), professional concerns (operating the school system in a manner that generates self esteem and peer group approval), and bureaucratic objectives (stability, conflict avoidance, and staff expansion). It is neither feasible nor necessary for development of the models to define these goals precisely nor to specify their relative weights in the district preference function. For our purpose, all that is necessary is to assume that achievement of district objectives depends systematically on resource inputs into schooling.

Alternatives to the constrained maximization approach have been suggested. For example, several process-oriented simulation models of budgetary behavior have been developed that treat in detail the decisionmaking mechanism in school districts and other governments.[1] There have also been attempts to explain allocative decisions in terms of bureaucratic responses to interest groups having different degrees of political power.[2] For the purpose of this study, however, these alternative approaches have the respective shortcomings that (a) process models tend to be highly specific to individual jurisdictions and require detailed information about them, while (b) the bureaucratic-political models tend to be nonquantitative. Since our objective is to establish a theoretical framework for empirical work using cross-sectional data on many districts, there seems to be no practical alternative to the constrained maximization approach.

Models of the allocative behavior of such governmental units as school districts and of individual households or consumers differ in the following important respect: In analyzing consumer behavior, it is usually appropriate to consider both income and prices as given. The purpose of the analysis is to explain how fixed budgets are allocated subject to fixed prices. In analyzing the behavior of governments, it is not clear that either budgets or prices should be considered fixed. A school district now only decides how to spend its budget, but also has at least some control over the size of its budget by virtue of its authority to set a local school tax rate.[3] A school district also has at least some control over the most important prices it faces, the salaries of teachers and other professional staff, by virtue of its power to set or negotiate school district salary schedules. Obviously, the district's control over either budget or prices is not unlimited, but neither is it zero. Several plausible assumptions about the scope of district discretion, each of which implies a somewhat different constrained maximization model, are explored here.

---

[1] See D. Gerwin, "A Process Model of Budgeting in a Public School System," *Management Science*, Vol. 15, No. 7, March 1969, pp. 338-361, and J. P. Crecine, "A Computer Simulation Model of Municipal Budgeting," *Management Science*, Vol. 13, No. 11, July 1967.

[2] For example, see Henry M. Levin, "Effects of Expenditure Increases on Educational Resource Allocation and Effectiveness," in J. Pincus (ed.), *School Finance in Transition*, Ballinger Publishing Company, Cambridge, Massachusetts, 1974.

[3] The extent of such authority varies with institutional arrangements. Some school systems are dependent on other jurisdictions in that they have no independent taxing authority, must obtain their revenue from a municipal or county government, and are subject to budgetary decisions of that higher-level jurisdiction. Many districts that do have independent authority to set and levy taxes, as most do in the

A complete constrained maximization model of school district resource allocation behavior consists of four elements:

(1) *An Objective Function:* a statement of what the school district seeks to maximize, specifying the form of the relationship among the different things that district officials value.
(2) *A Budget Constraint:* a statement of the limitations placed on school district choices of resource inputs either by a predetermined budget level or by the total income of the community.
(3) *A Price Determination Hypothesis:* a specification of whether prices are exogenous to the district, set by the district, or jointly determined along with expenditures.
(4) *Other Allocative Constraints:* restrictions placed on decisionmakers' options by tenure provisions, collective bargaining agreements, and organizational obstacles to change.

Alternative specifications of each element are described below.

OBJECTIVE FUNCTIONS AND BUDGET CONSTRAINTS

Although the objective function and the budget constraint are two distinct elements, the two must be treated together. That is, the budget constraint must stipulate what limits are placed on a district's ability to obtain the inputs or outputs that enter into its preference function. We consider two classes of models: (1) models that are

---

United States, are constrained by the requirement that tax rates or school budgets be approved by voters in referenda or tax elections.

designed only to explain the allocation of a fixed school district budget and (2) broader models designed to explain society's allocation of resources to public education and that therefore treat determination of the size of the budget and allocation of the budget together. The former approach leads to a formulation in which district officials maximize a function of district outputs or resource-use variables by selecting an optimal combination of resource inputs. The budget constraint is simply that the sum of amounts paid for each type of resource must not exceed the predetermined total budget. The latter, broader approach leads to a model in which the district seeks to maximize a function of school outputs or characteristics *and* other private and public goods. The corresponding constraint is that the sum of amounts spent for school resources and other goods must not exceed the disposable income of the community.[1] According to the broader model, school officials consider total community welfare in making their combined budget level and budget allocation decisions. The narrower model implies that a higher-level political decision has already been made about the overall division of the community's resources between schooling and other goods and that what remains is the problem of using the predetermined school budget most effectively.

Whichever approach is taken, the next step in developing the model is to specify what school district attributes appear in the preference function as things valued by school officials. There are three possibilities:[2]

(1) District officials value *educational outcomes* (e.g., pupil achievement) and seek the mix of inputs that will maximize

---

[1] An alternative formulation is that the district trades off valued educational outcomes or characteristics against the taxes it must levy on the community to provide them. The implications are somewhat different from those of the model in which the school district is concerned with overall community welfare. See S. M. Barro, *The Impact of Intergovernmental Aid,* Chapter III.

[2] For a somewhat different statement of the alternatives, see S. Carroll, *Analysis of the Educational Personnel System: III, The Demand for Educational Professionals,* The Rand Corporation, R-1308-HEW, October, 1973, Chapter II.

output(s) subject to overall constraints on resource availability and other restrictions on their freedom to allocate funds.

(2) Officials value *resource inputs* directly (i.e., they are better off politically, professionally, or bureaucratically when classes are smaller, teachers are more experienced, etc.), and they seek a utility maximizing input mix.[1]

(3) Officials value *both inputs and outputs*, and in choosing an optimal input mix they consider both how much the inputs will contribute to outputs and how much they will benefit the policymakers in other ways.[2]

Six different models can be obtained by combining these three concepts of what is to be maximized with both the narrow and broad formulations of the constrained maximization model. To systematically compare these alternatives, we need to state them mathematically. In the interests of brevity and simplicity, however, we restrict this exercise to the cases in which either outputs or inputs, but not both, appear as arguments of the preference function. Doing this reduces the number of models to be compared from six to four, but involves no substantial loss of information since the omitted models are combinations of the others.

---

[1] This is consistent with the proposition that officials really value output, but have so little knowledge of the underlying production functions that they must adhere to conventional wisdom about the value of inputs or to traditional practices in staffing and equipping schools. Another interpretation is that officials seek to please voters who judge the quality of a school system by such input characteristics as class sizes and the attractiveness of buildings and equipment. A third interpretation is that officials value inputs for such bureaucratic motives as the desire to preside over a large organization or to minimize the conflicts over resource allocation that are likely to arise when resources are scarce. The formulation of the constrained maximization model does not depend on which explanation or combination of explanations is true.

[2] This is consistent with the proposition that officials care about pupil achievement and attempt to obtain a set of inputs that will produce high output, but that they temper that objective to give the public what it wants in terms of inputs or to advance their bureaucratic or professional objectives.

The following notation is used throughout the discussion:

x_i = amount of resource input i per pupil ($i = 1...n$),
A_j = amount of educational outcome ("achievement") j per pupil ($j = 1...m$),
C_k = amount of "other good" (noneducation) k per capita ($k = 1...r$),
p_i = price of input i,
q_k = price of other good k,
B = the total school district budget (total dollars),
Y = community income (total dollars),
T = school district taxes (total local taxes for school purposes),
G = total outside (state and federal) grants to the school district,
S = number of pupils in the district,
N = population of the district,
z_1 = a vector of school district demographic and social characteristics, and
z_2 = a vector of characteristics of the pupil population that appear in the educational production function.

Using these variables, the four different versions of the school district constrained maximization model can be summarized as follows:

Model A. Selection of an Optimal Combination of Educational Outcomes and "Other Goods" Subject to a Constraint on Community Income

This is the most general form of the model since it includes educational and other goods and focuses on educational outcomes. The school district preference function may be written as

$$U = U(A_1 ... A_m, C_1 ... C_r, z_1), \tag{1}$$

where the educational outcomes (A_j) are related to resource inputs by a set of production functions,

$$A_j = F_j(x_1 \ldots x_n, z_2), \quad \text{for } j = 1 \ldots m\ .^{1} \qquad (2)$$

Partial derivatives of U with respect to educational outcomes and other goods (the A's and C's) and partial derivatives of production functions with respect to inputs (x's) are assumed to be positive. Characteristics of pupils (z_2) are included in the production functions to allow for variations in resource productivity among different types of pupils.

Assuming that all district revenues are derived either from taxes on residents or from external (state or federal) grants, the overall constraint on the community's ability to purchase educational inputs and other goods is

$$S\sum_i p_i x_i + N\sum_k q_k C_k = Y + G. \qquad (3)$$

This can also be expressed in terms of separate constraints on spending for school inputs and spending for goods other than education:

---

[1] This formulation of the production side of the model is crude because it implies that outcomes depend on the total amount of each type of resource consumed by the school district, but not on the way the resources are used. An alternative is to write

$$A_j = F_j(x_{1j} \ldots x_{nj}, z_2),$$

where x_{ij} is the amount of resource i allocated to production of output j and where the total requirement for resource i is given by

$$x_i = \sum_j x_{ij}.$$

This is still not entirely satisfactory, however, because it neglects the "joint production" aspect of much educational activity--i.e., the dependence of any one output, such as reading performance, on a number of school activities, such as reading instruction, social studies instruction, foreign language instruction, etc. A more adequate, but more complicated approach is to define a set of distinct educational activities or functions. Output can then be related to the amount of each activity provided (e.g., reading achievement can be related to the number of pupil-hours of classroom instruction in all subjects involving reading) and resource requirements, in turn, can be related to activities. While this is clearly superior to either of the simpler approaches, we do not develop it here since we do not intend to pursue the production function aspect of these models.

$$S\sum_i p_i x_i = T + G = B,$$

$$N\sum_k q_k C_k = Y - T \quad .$$[1]

However, these are only meaningful when combined since T is endogenous to the model.

Model B. Selection of an Optimal Combination of Educational Outcomes, Subject to a Given School District Budget

The effect of treating budget allocation as a suboptimization problem subsequent to determination of the overall budget level is to truncate the foregoing model. Taking the budget level as given, the function to be maximized becomes

$$U = U(A_1 \ldots A_m, z_1). \tag{4}$$

This maximization is subject to the production functions specified above and to the budget constraint,

$$S\sum_i p_i x_i = B. \tag{5}$$

In contrast to the preceding model, where B and T were to be determined, both are now assumed to be predetermined by a higher-level political decision.

The concept of separability of preferences provides a rationale for the suboptimizing approach to resource allocation reflected in this model. That is, if we assume that the preference function in Eq. (1) has the form

---

[1] In a more complete analysis we would have to allow for the fact that not all local school taxes are actually paid by district residents. Some of these taxes may be paid by owners of locally taxable property who live elsewhere. In that event, it would be necessary to modify these two equations so that the T term in the first one represents total local school taxes while the T term in the second represents only

$$U = U[U_1(A_1 \ldots A_m, z_1), U_2(C_1 \ldots C_r, z_1)],$$

then preferences regarding the A's are said to be separable from preferences regarding the C's in the sense that a change in the mix of C's, holding U_2 constant, does not affect the choice of A's. (And a change in the mix of A's, holding U_1 constant, does not affect the choice of C's.) Given the fraction of total resources (community income plus grants) allocated to education, an optimum mix of school resources can be computed by considering only U_1. A separate computational process is needed to select a grand optimum out of all such budget-constrained suboptima. The calculations pertaining only to U_1 correspond to the budget allocation stage of the overall allocative process and calculations of the grand optimum correspond to the budget determination stage. Only the former is represented in Eqs. (4) and (5) of model B.

Model C. Selection of an Optimal Combination of School Resources and "Other Goods," Subject to a Constraint on Community Income

The effect of assuming that districts value inputs rather than outputs is to simplify the models by eliminating the need to consider production functions. Assuming that district officials value school inputs and other non-educational goods, the objective function is the same as that in model A (Eq. 1) except that inputs (x's) are substituted for outputs (A's); i.e.,

$$U = U(x_1 \ldots x_n, C_1 \ldots C_r, z_1). \tag{6}$$

The budget constraint is the same as in Eq. (3). Again, it makes sense to think about a separable preference function in which marginal rates of substitution among the resource inputs to schooling are not affected by changes in the mix of noneducational goods.

Note that at this level of abstraction models A and C become virtually indistinguishable. That is, if the production functions

---

that fraction of total taxes paid by community residents. For more information on this issue, see S. M. Barro, *The Impact of Intergovernmental Aid,* Chapter IV.

(Eq. 2) are substituted into the preference function (Eq. 1) in model A, we have

$$U = U[F_1(x_1 \ldots x_n, z_2), \ldots, F_m(x_1 \ldots x_n, z_2), C_1 \ldots C_r, z_1]$$

$$= U'(x_1 \ldots x_n, z_2, C_1 \ldots C_r, z_1),$$

which is the same as Eq. (6) except for the presence of z_2.[1] Of course, the two models may no longer be equivalent when explicit functional forms are psotulated for the preference and production functions. But since the choice of functional forms is not likely to be determined on theoretical grounds--the theory being too weak to select one functional form as preferable to another--the outcome-oriented and input-oriented hypotheses remain equivalent for empirical purposes.[2]

Model D. Selection of an Optimal Combination of School Resources, Subject to a Given School District Budget

The input-oriented model in which the budget level has been predetermined is a simplified form of model B. The objective function is

---

[1] The presence of pupil characteristics (z_2) in this model but not in model A may not constitute an empirically meaningful difference. The reason is that the relevant pupil characteristics are likely to be very highly correlated with the community characteristics (z_1) that already appear in model C. For example, pupil socioeconomic status appears as a determinant of achievement in virtually every production function study; at the same time, variables closely related to socioeconomic status, such as community income and occupational or educational status, appear as independent variables in expenditure determinants studies.

[2] The similarity between the two models is somewhat lessened if more complicated production function relationships, such as those suggested in the footnote on p. 110 are postulated. Then, the way in which resources are used remains an important consideration that is independent of the amount of resources available, even when production functions are substituted into Eq. (1). The resulting model would be different from one in which only resource amounts count, such as model C. One might also reasonably assume, however, that school officials care about resource use (i.e., the mix of instructional and other activities in the schools) even if they are not directly concerned with outcomes. Thus, the distinction between the input-oriented and output-oriented approaches becomes even more blurred.

$$U = U(x_1 \ldots x_n, z_1),$$

and the budget constraint is the same as Eq. (5). A nearly identical model could have been obtained simply by substituting the production functions into the preference function of model B (Eq. 4). This version of the model is parallel in all respects to the standard model of consumer demand, in which a given amount of income is to be allocated among alternative categories of consumption. In the following section, however, we consider the implications of modifying the consumer-type model in one important respect; namely, by treating prices as endogenous variables rather than as predetermined elements of the budget constraint.

As explained in the Introduction, the empirical work in Chapters II through VI reflects the narrowest of the four models, model D. Selection of the most restrictive model involves relatively little loss of generality. As pointed out above, the two models containing outputs in their preference functions (models A and C) can be translated into models containing input arguments only (models B and D) by substituting the production functions into the expressions to be maximized. As a practical matter, there is little to be gained by keeping the production functions explicit and attempting to estimate their parameters. Where this has been tried in the context of an allocation model, it has not been successful (see Brown, "Achievement, Costs, and Demand"). In general, attempts at estimating educational production functions have yielded largely negative findings about the extent to which inputs and outputs are related.[1] Therefore, it is unlikely that empirical explanations of school district resource allocation behavior can be improved by working with models that purport to relate resources to achievement-type outputs. As to the distinction between models B and D, the assumption of separability of preferences allows budget allocation and budget determination to be viewed as separate stages of decisionmaking, even in analyzing model B. The part of model B that pertains to allocation is equivalent to model D. Moreover, separability of preferences seems to be both a plausible and empirically sound assumption about behavior in the real world. It is unlikely, for example, that a school district's decisions about tax rate and budget level would be significantly affected by changes in the relative prices paid for different school district inputs.[1] Therefore, we have developed empirical models that are consistent with the proposition that the district budget is fixed and that resources are valued directly--not necessarily for their contributions to output--by school district officials.

---

[1] A review of this literature appears in Harvey A. Averch, et al., *How Effective is Schooling?*, The Rand Corporation, R-956-PCSF/RC, March 1972.

PRICE DETERMINATION HYPOTHESES

In the foregoing discussion, prices of school resources were treated as givens. The resulting models are no different from consumer demand models. They yield the usual implications of demand theory--positive effects of income (budget) and negative effects of prices (salaries) on quantities of resources demanded--and nothing more. However, the assumption that the main input prices, the salaries of teachers and other professional personnel, are exogenously determined is not the most plausible one to make in the case of school districts. We now consider the implications of two alternative hypotheses, each of which significantly alters the character of the model:

(1) Professional salary levels or schedules are *policy variables* set by district officials.

(2) Salaries are negotiated between districts and employee organizations and thus are *jointly determined* along with the budget level and related fiscal variables.

---

[1] One clear exception is the case in which the amount of state or federal aid money available to a district depends on the district's allocative decisions. In a number of Southern states, such a condition is created by state aid formulas that relate a district's aid entitlement to the number of teachers employed and their experience or educational levels. Since our empirical work uses data from the State of Michigan, where no such provisions are in effect, no immediate problem is created for this study. Nevertheless, the general theoretical problem should be addressed in future research.

Salary as a Policy Variable

The assumption underlying the policy variable hypothesis is that districts value teacher and staff quality as well as the number of teachers or professional staff per pupil. A district can trade off numbers of teachers for higher quality by setting its salary level higher than in other districts in its labor market area. Variations in salary levels among districts in a given market area are accounted for, in part, by predilections either for quality or number of teachers. These predilections may, in turn, be related to measurable district characteristics, such as the socioeconomic make-up of the community. One can think in terms of a teacher supply schedule relating quality to salary. If x_1 is the number of teachers per pupil, q_1, is teacher quality, and x_2 represents the quantity of all other inputs per pupil, then the preference function would be

$$U[x_1, q_1, x_2; z],$$

and maximization would be subject to the constraint

$$x_1 p_{1m}(q_1) + x_2 p_2 = b,$$

where $p_{1m}(q_1)$ is the salary level required to obtain teachers of quality q_1 in the market area designated by m, where $b = B/S$, the budget per pupil, and where z is the vector of all other district characteristics that affect input choices.

An alternative explanation of why a district may set a higher salary level than other districts in the area is that by doing so, it assures itself of having first choice, or at least a large selection, among candidates for teaching jobs. The advantage of this formulation is that it avoids the problems associated with attempts to define and measure teacher quality by recognizing that a wide choice is important in itself, even if, in the end, each district uses its own idiosyncratic, subjective standards for choosing among applicants. The implication for modeling is that the level of the salary schedule itself (or, strictly speaking, the level relative to that in competing districts) should appear in the preference function. Thus, the district is seen as maximizing

$$U(x_1, p_1/p_{1m}, x_2; z),$$

subject to

$$x_1p_1 + x_2p_2 = b,$$

where p_{1m} is the prevailing salary level in the district's market area.

The implications of the two formulations are similar. Taking the latter model, which is somewhat simpler, the conditions for mazimization are

$$\frac{\partial U}{\partial x_1} - \lambda p_1 = 0 \quad \frac{\partial U}{\partial p_1} - \lambda x_1 p_{1m} = 0 \quad \frac{\partial U}{\partial x_2} - \lambda p_2 = 0 .$$

The resulting demand equations for x_1 and p_1 constitute a simultaneous system:

$$x_1 = x_1(b, p_2, p_1/p_{1m}, z),$$

$$p_1/p_{1m} = f(b, p_2, x_1, z).$$

It is also possible to transform these relationships into reduced-form equations relating both x_1 and p_1/p_{1m} to b, p_2, and z. The main point is that the level of the salary schedule is not a given in these hypotheses, but is itself a function of the district budget.

It is compatible with this approach to assume that the supply of teachers and other professionals available to a district is affected by other labor market characteristics, such as the degree of unionization in a district and the laws governing collective bargaining. There is a growing literature on the influence of such factors on wages of teachers and other public employees.[1] These supply-side factors could be taken into account by treating them as modifiers of the price-quality relationship; that is, instead of assuming that price in a given labor market is given by $p_{1m}(q_1)$, we could allow for a more general supply function of the form $p_{1m}(q_1$, ORG, CB), where ORG is a measure of the extent of organization of teachers and other education professionals and CB is a measure of the strength of collective bargaining arrangements.[2] In the same spirit, one could allow for variations in supply related to the differential attractiveness of different districts to teachers by including in the supply function those community characteristics, such as socioeconomic status indicators, that might affect the salary level needed to attract a given quality of teacher to a particular district. Furthermore, in the event that the concept of the market area salary level proves to be unworkable, say, because large city and county districts and isolated nonmetropolitan districts may constitute their own market areas, these formulations can be augmented by including measures of the opportunity wage for teachers in alternative occupations. Efforts have been made to measure the alternative wage in a number of different ways in salary determination studies.[3]

---

[1] See, e.g., Hirschel Kasper, "The Effects of Collective Bargaining on Public School Teachers' Salaries," *Industrial and Labor Relations Review,* Vol. 24, October 1970, pp. 57-71; Robert J. Thornton, "The Effects of Collective Negotiations on Teachers' Salaries," *Quarterly Review of Economics and Business,* Winter 1971, pp. 37-46; and Roger W. Schmenner, "The Determination of Municipal Employee Wages," *Review of Economics and Statistics,* Vol. 60, No. 1, February 1973, pp. 83-90.

[2] Schmenner uses three variables to characterize the state of collective bargaining in a jurisdiction: (a) the percentage of employees who are members of the union, (b) a dummy variable indicating the presence of formal collective bargaining agreements, and (c) the incidence of work stoppages per employee (public and private) in the area. The rationale for the last of these, according to Schmenner, is that "work stoppages have a demonstration effect for public employees." Thornton relies primarily on a dummy variable that indicates whether a school district signs formal contracts with a recognized teacher organization. He also points out some of the potential pitfalls of relying too much on measures of the extent of teacher organization as an indicator of bargaining strength.

[3] Thornton uses an average wage of employees in the city or surrounding area (exact categories of employees included are not speci-

Negotiated Salaries

The proposition that salaries are negotiated between school systems and teacher organizations, rather than imposed by either party, accords with everyday experience. Collective bargaining takes place regularly in school districts. Frequently there are offers and counter-offers, strike threats, and recourse to mediation; the final result usually is somewhere in between the teachers' initial demands and the district's first offer. It often seems that the key issue in bargaining is how available funds should be divided; specifically, how much of any available uncommitted revenue should go for increases in teacher pay. No matter how the bargaining process is characterized, it seems reasonable to hypothesize that the pay increase will be higher when the budget (or budget increase) is higher. Thus, it follows, as in the model set forth above, that salary levels can not be treated as fixed, but must be viewed as simultaneously determined along with quantities of resources. It is also plausible that outcomes of collective bargaining will reflect the relative power of the two parties. but power is a difficult concept to operationalize. The variables that first come to mind as indicators of bargaining strength are the same measures of the extent of union organization and indicators of the nature of collective bargaining arrangements as were suggested above. There have been very few suggestions about variables that might represent the strength of the management side in collective bargaining negotiations, other than those that represent weakness of the employee organizations.[1] The problem with the collective bargaining approach is that it is difficult to go beyond these plausible, intuitively appealing, but nonrigorous hypotheses to develop a model with different implications from the market-type model set forth

---

fied). Schmenner uses Bureau of Labor Statistics data on salaries of clerical workers in the area as his measure of the opportunity wage for teachers. The latter approach is followed in the empirical portions of this study.

[1] It has been argued that large districts enjoy certain monopsony powers because of limited mobility in the labor pool; see J. Landon and R. Baird, "Monopsony in the Market for Public School Teachers," *American Economic Review*, Vol. 61, December 1971, pp. 966-971. Schmenner suggests that an independent school district may be a stronger bargainer than a dependent system because its funds are less fungible, but the argument is not compelling.

above.[1] To develop a distinctive bargaining model, it would probably be necessary to characterize the bargaining process itself, perhaps in a game-theoretic framework. To do this would require a long-term research effort. Meanwhile, the main contribution of the negotiated salary approach is that it provides an interpretation for the labor market variables--extent of organization and presence of formal collective bargaining--that appear in market models of salary determination.

OTHER ALLOCATIVE CONSTRAINTS

The general equilibrium constrained maximization models outlined above do not capture the effects of nonbudgetary constraints, some imposed by law and some created by nonwage provisions of collective bargaining agreements, that limit the resource allocation decisions of school district officials. The most important are constraints on decisions about numbers of teachers (teacher-pupil ratios) and the mix of teachers to be employed. In many instances, there are also constraints on a district's decisions about the number and types of administrators and other professional personnel that it can hire. The effect of these restrictions is that school districts may be prevented from reaching or moving toward the pattern of allocation that would be optimal from the point of view of local officials. Restrictions on a district's choices include the following:

1. The custom of paying teachers according to a schedule that rewards teachers exclusively for seniority and training prevents districts from using wage incentives to attract teachers with other desirable characteristics or from rewarding teaching performance.
2. Tenure provisions in state education laws or in collective bargaining contracts limit a district's ability to influence the composition of the teaching force with respect to experience, training, or any other attribute. Although districts

---

[1] Schmenner attempted to develop both a collective bargaining model and a supply-demand market model, but ended up concluding that the two were empirically indistinguishable.

must pay for experience and training, average experience and educational levels are determined mainly by individual decisions of the teachers themselves. A district is not free to trade off teacher experience for numbers of teachers by employing a younger, less experienced staff, except to the extent that voluntary terminations make it possible to recruit new staff members.

3. Other seniority provisions, such as those governing the sequence in which teachers shall be laid off in the event of declining budget or enrollment, further restrict a district's choices regarding the characteristics of the teaching force.
4. Limitations on class size, frequently incorporated into collective bargaining agreements, restrict a district's opportunities to trade off teachers for other kinds of staff, such as paraprofessionals.

As a consequence of these restrictions, a district's choices in any given year are very much limited by the mix of teachers and other resources employed by the district in the previous year. We have attempted neither to describe these constraints mathematically nor to incorporate them into the constrained maximization model. It would have been possible to do so, but it would have been necessary to disaggregate the model sufficiently to permit characterization of a district's teaching force by age, experience, and level of training. The possibilities of testing such a model empirically seemed too limited to us to justify pursuit of this line of theoretical inquiry. However, concern about the effects of constraints did lead us to develop the discretionary budget analyses presented in Chapters V and VI, in which the problem of precommitted resources is addressed in a more aggregative and less direct manner.